

September 21, 2010

Mr. Dave Tomten USEPA 1435 N. Orchard Street Boise, ID 83706

RE: Supplemental Sediment and Riparian Soil Sampling and Analysis Plan-Revision 1 Final

Dear Dave:

Please find P4 Production's attached revised Supplemental Sediment and Riparian Soil Sampling and Analysis Plan - Revision 1 Final (Supplemental Sediment SAP-Rev 1 Final). P4/MWH received your email on September 16, 2010 indicating that the A/Ts have accepted our responses to your additional comments (RTCs) and that P4 has approval to begin the field program discussed in this document.

The Supplemental Sediment SAP – Rev 0 was originally submitted to the A/Ts on July 21, 2010. The initial A/T comments on the Supplemental Sediment SAP were received on August 12, 2010. P4/MWH prepared RTCs that were submitted electronically to the A/Ts on August 19, 2010. Additional A/T comments were received on September 2, 2010 in response to P4's initial RTC document. P4/MWH then prepared an additional RTC document that was submitted to the A/Ts on September 9, 2010. P4/MWH now is providing this final version of the Supplemental Sediment SAP-Rev 1 Final, which has been revised based on those two RTC documents and your acceptance of our responses. As discussed in an earlier correspondence, this Supplemental Sediment SAP-Rev 1 Final should be inserted into Appendix D1 of the RI/FS Work Plan for P4's Ballard, Henry and Enoch Valley Mines. The document provided is 3-hole punched for insertion.

P4 indicated to the A/Ts during the last bi-weekly call on September 13, 2010 that this field effort could start as early as September 23rd depending on several factors at the Site. P4 will let the A/Ts know the exact data ASAP so that you can come and observe this field effort, if desired.

Should you have any questions on the information provided in this letter or suggested revisions to the attached document, please contact Barry Koch at (208) 547-1439 or me at (801) 617 3250.

Best Regards,

Vance Drain, P.G. (PM for P4)

Nauce K Q.

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Mr. Dave Tomten USEPA September 21, 2010 Page 2 of 2

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SUPPLEMENTAL SEDIMENT AND RIPARIAN SOIL SAMPLING AND ANALYSIS PLAN

Revision 1 FINAL

September 2010

Prepared by:

MWH AMERICAS, INC.

Prepared for:

P4 PRODUCTION, LLC

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ACRONYMS AND ABBREVIATIONS

A/T Agencies and Tribes

AVS/SEM Acid volatile sulfides/simultaneously extracted metals
BLM Bureau of Land Management (Department of Interior)

BMP Best Management Practice

cm Centimeter

CO/AOC Consent Order/Administrative Order on Consent

COPC Contaminant of Potential Concern

COPEC Contaminant of Potential Ecological Concern

CSM Conceptual Site Model

DOI Department of the Interior

DQOs Data Quality Objectives

EE/CA Engineering Evaluation and Cost Analysis

e.g. exempli gratia (Latin, for example)

ERA Ecological Risk Assessment

FS Feasibility Study

FSP Field Sampling Plan

ft Feet

HHERA Human health and ecological risk assessment

HASP Health and Safety Plan

IDEQ Idaho Department of Environmental Quality

i.e. *id est* (Latin, that is to say; in other words)

MWH MWH, Inc. (formerly Montgomery Watson Harza, Inc.)

P4 Production, L.L.C.

QAPP Quality Assurance Project Plan

SAP Sampling and Analysis Plan

SI Site Investigation

SOP Standard Operating Procedure

Tribes Shoshone-Bannock Tribes

USEPA United States Environmental Protection Agency

USFS United States Forest Service

1.0 INTRODUCTION

This Sampling and Analysis Plan (SAP) has been prepared to describe the locations, rationale, and methods/procedures for the collection and analysis of sediment and riparian soil samples from locations within and downstream of the three historic P4 Production (P4) phosphate mines (i.e., the Ballard, Henry, and Enoch Valley Mines collectively known as "the Sites") in southeastern Idaho. This SAP has been prepared in conjunction with, and will be attached to, the Remedial Investigation/Feasibility Study Work Plan (RI/FS Work Plan) for the comprehensive mine-specific RI/FS that is being conducted at the Sites.

This document has been prepared by MWH Americas, Inc. (MWH) on behalf of P4, in accordance with the requirements of the Administrative Settlement Agreement and Order on Consent/ Consent Order for Remedial Investigation/Feasibility Study (2009 CO/AOC; USEPA, 2009). The 2009 CO/AOC is a voluntary agreement between P4 and the United States Environmental Protection Agency (USEPA), the Idaho Department of Environmental Quality (IDEQ), the United States Department of Agriculture, Forest Service (USFS), the U.S. Department of the Interior (DOI), Bureau of Land Management (BLM), the Shoshone-Bannock Tribes (Tribes), collectively referred to as the "Agencies and Tribes" or A/T.

The primary plans necessary for any SAP include a: Field Sampling Plan (FSP), Quality Assurance Project Plan (QAPP), and Health and Safety Plan (HASP). In this SAP, the FSP and QAPP components specific to the supplemental sediment and riparian soil sampling program are provided in Appendix A. A project-specific HASP hazard analysis for sediment and riparian soil sampling is provided in Appendix B. In addition, the primary QAPP (and QAPP Addendum) and HASP for the overall RI/FS program are provided by reference in Appendices D5 and E of the RI/FS Work Plan. These important RI/FS plans will be available to the field teams as they begin this work. A key component of the project planning process includes an evaluation of the Data Quality Objectives (DQOs) for the sediment and riparian soil sampling effort. This analysis is presented in Section 2.0.

While the SAP components are often prepared as stand-alone documents, it needs to be recognized that this characterization is part of the overall characterization of the Sites within the RI/FS. Therefore, the more extensive RI/FS Work Plan components are not repeated herein (e.g., site background and data gaps analyses). The reader is referred to the following sections in the RI/FS Work Plan for a complete discussion of:

- Section 2.0 Site background
- Section 3.0 Existing data for each medium at each mine
- Section 4.0 Data gaps identified for each medium at each mine

Section 4.0 includes information related to the need for additional sediment and riparian soil sample collection at the Sites (especially in Section 4.4.1).

Section 1.1 below, presented the objectives of the proposed supplemental sediment and riparian soil sampling effort at the Sites. Detailed information related to the location and rationale of individual sampling sites is presented in Section 2.0.

1.1 Background and Objectives

The current conceptual understanding and relevant data from the three mine areas being investigated under the RI/FS are presented in Section 3.0 of the RI/FS Work Plan. Much of the work completed to date has focused on upland soil and sediment sampling, however, during the March 3, 2010 RI/FS data gap scoping meeting, the A/T identified that several of the metal analytes that were detected in soils throughout the Sites were not included in the target analyte lists in previous sediment investigations. Table 1-1 shows a comparison among the soil, surface water, and sediment samples that have been collected at the Sites previously, as well as the analytes that were detected in these samples. This comparison reveals that some analytes (e.g., arsenic) were not run in samples collected for sediment analysis, but they were detected, and in some cases occurred at levels above relevant screening levels, in soil samples. Therefore, additional sediment and riparian soil sampling are proposed to fill this data gap based on lack of specific metal data. Based on this data gap and others identified from the evaluation conducted in Sections 3.0 and 4.0 of the RI/FS Work Plan, the following three objectives are presented for this field effort:

- 1) <u>Sediment Transport Investigation</u> Sampling conducted to determine the nature and extent of constituents of potential concern (COPCs) and constituents of potential ecological concern (COPECs) in sediments moving downstream from the mine sites (i.e., possible sources of COPCs and COPECs) to the perennial streams that provide suitable aquatic habitat in the area. When possible, the proposed sediment/riparian soil sampling transects will be located in areas that have historically elevated analyte concentrations, but were missing some analytes detected in upslope soils. The sampling locations (i.e., transects) and procedures are discussed in the FSP in Appendix A of this SAP.
- 2) <u>Ecological Exposure Evaluation</u> Sampling conducted to determine the nature and extent of COPECs in sediments collected from streams located on or in the vicinity of the Sites, and ponds located on the Sites. The aquatic portion of the ecological risk assessment (ERA) for the Sites will evaluate permanent streams that support populations of benthic invertebrates and fish, and ponds that support populations of benthic invertebrates, as well as upper trophic level avian and mammalian receptors that forage on aquatic dietary items within these surface water features. Several streams have headwaters originating at the Sites, and other streams flow through or past the Sites, that support viable aquatic habitat and could potentially be impacted by contaminants derived from the Sites. In addition, several ponds on the Sites that support aquatic habitat (e.g., benthic macroinvertebrates, as fish have not been found in the on-Site ponds) may be impacted by surface water runoff from P4 operations. Sediment sampling results for these surface water features will be used to identify sediment COPECs, and corresponding concentrations of COPECs, for use in evaluating potential exposures to aquatic and/or riparian ecological receptors.
- 3) <u>Sediment Background Conditions</u> Sampling to be conducted at eight upgradient locations, to establish background concentrations in sediment and riparian soils for those analytes where there are no current data and to provide adequate sample numbers for statistical analyses.

Riparian soils are proposed for collection because sediments likely are deposited in these zones during spring flood events.

1.2 Document Organization

The introduction including the background and project objectives are contained in Sections 1.0 and 1.1, above, and a site location map is presented in Drawing 1, Location Map with Proposed Sediment and Riparian Soil Sampling Locations and Historic Results. Section 2.0 includes a detailed discussion of the project data quality objectives (DQOs). Appendices necessary for the field teams to complete this specific scope of work include:

- Appendix A Field Sampling Plan (with necessary QAPP components)
- Appendix B Health and Safety Plan Activity Hazard Analysis
- Appendix C Document Comments and Responses

2.0 DATA QUALITY OBJECTIVES

The DQOs discussed in this section were used to guide the development of the components of this SAP (FSP and QAPP in Appendix A). The DQOs identify the quantity and quality of data that must be obtained to complete sediment and riparian soil characterization and to support the decision making process related to the RI/FS program.

2.1 DQO Presentation

The DQOs described herein are consistent with USEPA guidance (USEPA, 2006a) and apply the following seven-step process:

- 1. State the problem
- 2. Identify the goals of the study
- 3. Identify information inputs
- 4. Define the boundaries of the study
- 5. Develop the analytic approach
- 6. Specify performance or acceptance criteria
- Develop the plan for obtaining data

DQOs have been developed for both stream and pond locations. Within the DQOs, the principal study questions (from Step 2) have corresponding statements, as appropriate, in each of the remaining DQO steps. Outputs are given in each step and follow the 2006 DQO guidance (USEPA, 2006a). A general discussion of the supplemental sediment and riparian soil sampling program objectives is presented in Section 1.1.

Each step of the DQO process defines criteria that will be used to establish the final data collection design. The first five steps are primarily focused on identifying qualitative criteria, such as:

• The nature of the problem that has initiated the study and a conceptual model of the environmental hazard to be investigated.

- The decisions or estimates that need to be made and the order of priority for resolving them.
- The type of data needed.
- An analytic approach or decision rule that defines the logic for how the data will be used to draw conclusions from the study findings (USEPA, 2006a).

The sixth step in the DQO process establishes acceptable quantitative criteria on the quality and quantity of the data to be collected, relative to the ultimate use of the data. For this characterization project, the data are primarily collected for the estimation of COPC and COPEC sediment concentrations in stream reaches and ponds with viable aquatic habitat in support of the risk assessments for the Sites.

In the seventh step of the DQO process, a data collection design is developed that will generate data meeting the quantitative and qualitative criteria specified at the end of Step 6. The output from this step is largely contained in the FSP (in Appendix A). Table 2-1 presents detailed information related to each of the seven DQO steps for the proposed sediment and riparian soil investigation discussed in this section of the document. Additional supporting information necessary to make informed decisions is provided in Section 2.2 below.

2.2 Supporting Information

Two key factors that need to be considered in the DQO process are the conceptual model, for helping formulate the problem statements (DQO Step 1) and, in this case, the facility drawing for identifying the spatial bounds of the program. The facilities are presented in Drawing 1 to support the DQOs detailed in Table 2-1. Further information supporting the sample type, size and distribution is also presented in this section.

2.2.1 Conceptual Model

The primary components of the conceptual model based on the conceptual site model (CSM) in the RI/FS Work Plan (see Figures 3-58 and 3-59 in the RI/FS Work Plan) for sediment transport that support the DQOs are summarized as follows:

- Source COPCs/COPECs present in interburden and overburden rocks deposited in waste rock dumps, but possibly present in mine pits and other facilities.
- Release mechanisms the primary release mechanism is leaching of COPCs/ COPECs s into the aqueous groundwater and surface water systems. In areas with elevated aqueous concentrations of COPCs/COPECs, sorption to sediments may occur resulting in elevated sediment concentrations. An important secondary release mechanism may be the physical erosion of solid rock or soil particles from waste rock areas into the surface water system. It is this secondary released mechanism that will be primarily evaluated; although, elevated COPCs/ COPECs concentrations from sorption will also be evaluated.
- Exposure pathways primary exposure through ingestion of COPCs/COPECs in sediments by aquatic organisms. Secondary exposures are possible through uptake by plants and consumption of aquatic organisms by higher trophic level receptors.
- Receptors aquatic organisms, higher trophic level birds and mammals that
 consume aquatic organisms, and humans through the consumption of fish and
 culturally significant plants (i.e., water cress).

These conceptual model components will be re-evaluated, refined, and verified as the project moves into risk assessment. The primary objective of the study presented in this SAP is the characterization of the nature and extent of COPCs/COPECs within the study boundaries. These data will then be available to help facilitate the determination of potential risks to human health and ecological receptors.

2.2.2 Facility Maps

Sediment and riparian soil sample locations for the Sites are provided in support of the DQOs on Drawing 1. The map includes the ponds and stream reaches to be characterized and relevant historical sampling locations with 2004 sediment selenium data presented.

2.2.3 Existing Data

Sediment and riparian soil data have been collected from stream and pond locations as part of the 2004 EE/CA Site Investigation and prior to that during the Area-Wide Studies. All of these data are presented and described in the *RI/FS Work Plan*. Specifically the data for sediment is presented in Sections 3.2.3, 3.3.3, and 3.4.3 for the Ballard, Henry and Enoch Valley Mines, respectively. The riparian soil data are similarly reported in Sections 3.2.1, 3.3.1 and 3.4.1. These data are not described again in this SAP. However, it is noted that sediment sampling in the vicinity of the Sites was conducted in 1998, 1999, 2000, 2002 and 2004. The follow analytes were evaluated:

- 2004 selenium, cadmium, chromium, nickel, vanadium, zinc, and pH
- 2002 selenium, cadmium, chromium, nickel, vanadium, zinc, cobalt, copper, and pH
- 2000 selenium, cadmium, calcium, iron, magnesium, manganese, nickel, potassium, sodium, sulfate, vanadium, zinc, and pH
- 1999 selenium, cadmium, calcium, iron, magnesium, potassium, sodium, sulfate, and pH
- 1998 selenium, cadmium, calcium, iron, magnesium, manganese, nickel, potassium, sodium, sulfate, vanadium, zinc, and pH

In comparison to these analytes lists, Site soils have been analyzed for: antimony, arsenic, boron, cadmium, chromium, cobalt, copper, manganese, mercury, molybdenum, nickel, selenium, silver, thallium, uranium, vanadium, and zinc.

As noted in the RI/FS Work Plan, and elsewhere, selenium is the best indicator for impacts from phosphate mining in southeastern Idaho. The 2004 sediment selenium data are depicted on Drawing 1.

2.2.4 Discussion of Sampling Locations and Rationale

Samples of sediment and associated riparian zone soils will be collected along the stream channels and analyzed by the methods and for the analytes listed in Section 2.2.5. In addition, where possible, a surface water sample will be collected at each sediment location that has water at the time of sampling. Riparian soils are defined to be the soils deposited along the banks of the streams by high water or flooding of the stream. The locations where the samples will be collected are presented here for each of the Sites. The planned locations are listed on Table 2-2 along with the associated rationale. The following discussion presents the rationale for the collection of sediment samples. The overall rationale for the investigation is that during the March 3, 2010 RI/FS data gap scoping meeting, the A/T identified a potential data gap for sediments. The A/T noted that several of the metal analytes that were detected in upland soils throughout the Sites were not included in the target analyte lists in previous sediment investigations. This meeting topic led to the proposed locations and sampling activities in described in this SAP. In addition, to support sediment sampling in each stream location, a riparian soil sample and a surface water sample (where possible) also will be collected. For some of the stations at the Ballard Mine, surface water may not be presented at the time of sampling, and therefore, cannot be collected.

The aquatic portion of the ERA for the Sites will evaluate permanent streams that support populations of benthic invertebrates and fish, and ponds that support populations of benthic invertebrates, as well as upper trophic level avian and mammalian receptors that forage on aquatic dietary items within these surface water features. Several streams have headwaters originating at the Sites, and other streams flow through or past the Sites, that support viable aquatic habitat and could potentially be impacted by contaminants derived from the Sites. In addition, several ponds on the Sites that support aquatic habitat (e.g., benthic macroinvertebrates, as fish have not been found in the on-Site ponds) may be impacted by surface water runoff from P4 operations. Sediment sampling results for these surface water

features will be used to identify sediment COPECs, and corresponding concentrations of COPECs, for use in evaluating potential exposures to aquatic and/or riparian ecological receptors.

Rapid bioassessment surveys (RBS) were conducted for streams on, and in the vicinity of, the Sites to characterize the habitat quality of flowing waters. Results of these surveys, and associated RBS scores, are summarized in Table C4-5 of the Draft Human Health and Ecological Risk Assessment (HHERA) Work Plan for the Sites (Appendix C of the RI/FS Work Plan). None of the stations evaluated at the Ballard Mine had, or were likely to have, fish present and had corroborating low RBS scores. RBS scores for the other two mines ranged both higher and lower than at Ballard, and both mines showed the presence, or likely presence, of fish at approximately half the stations evaluated. For reference, streams with RBS scores greater than or equal to approximately 54 are likely to support fish.

An aquatic functional use survey of the ponds (non-regulated surface water features) located at the Sites was conducted in June 2004 (IDEQ, 2004). This review categorized all on-Site ponds into one of three tiers, as follows:

- Tier 1 surface water features that appeared to provide adequate open water, emergent vegetation, protective cover, and food sources to support a local resident migratory bird population during typical nesting/breeding seasons.
- Tier 2 surface water features within grazing allotments, those exhibiting evidence
 of livestock use, or ponds with a reasonable potential for future livestock use as
 drinking water.
- Tier 3 surface water features used as an occasional drinking water source by transitory terrestrial wildlife.

Results of the pond survey, by individual mine, are summarized in Table C4-4 of the Draft HHERA Work Plan (Appendix C of the RI/FS Work Plan). None of the ponds at Ballard Mine (n=5) are Tier 1 ponds; however, two ponds at the Ballard Mine are categorized as Tier 2. Two of the four ponds at Henry Mine are Tier 1 ponds and 1 pond is identified as a Tier 2

pond. Four of the eight ponds at Enoch Valley Mine are Tier 1 ponds and the other four ponds are identified as Tier 2 ponds. Consistent with results of the functional use survey, sediment sampling of the ponds will be conducted as follows on Tier 1 and select Tier 2 ponds:

- Ballard Mine No ponds will be sampled as no ponds were classified as Tier 1 as
 well as the Tier 2 ponds are dry or have been backfilled.
- Henry Mine Two (2) Tier 1 ponds and one (1) Tier 2 pond will be sampled.
- Enoch Valley Mine Four (4) Tier 1 ponds and two (2) Tier 2 ponds will be sampled.

Details regarding the specific streams and ponds to be sampled are discussed on a minespecific basis in the following subsections.

2.2.4.1 Ballard Mine

The Ballard Mine is the least reclaimed of the three mines and, as a result, has the greatest potential for contaminated sediment migration. Active erosion has been observed on the unreclaimed areas of the mine. In addition, the existing sediment data suggests some downstream transport of COPCs/COPECs (e.g., selenium). Seven existing stream locations have been selected to assess the extent of downstream transport of sediment and COPCs/COPECs from the Ballard Mine. In addition, one background location has been selected. These stations are listed in Table 2-2 and shown on Drawing 1.

Most of the sampling will be conducted on stream locations draining the east and west sides of the mine - Wooley Valley Creek (and tributaries) and the larger western tributary to the Blackfoot River that originated in the mine. Five locations have been selected in the Wooley Valley Creek with each successive location further downstream of the mine area (MST095, 092, 089, 273 and 272 from upstream to downstream). Selenium data (Drawing 1) suggest that downstream transport is occurring on Wooley Valley Creek, but that it is not reaching the Blackfoot River above background concentrations (generally the MDL to approximately 3 mg/kg; background will be established during the RI). The planned sampling will verify

that COPC/COPEC concentrations in sediment are consistent with the COPC/COPEC concentrations in soil and the extent to which COPC/COPEC concentrations in sediment have moved downstream from the Site. Two background samples will be collected on Wooley Valley Creek above any influence from the Site (MST093).

The objective on the west side of the Ballard Mine is the same. However, the tributary stream is in several broken segments prior to reaching the Blackfoot river due to roads intersecting the channel. Two samples will be collected between the mine and the Blackfoot River, one upstream near the toe of MWD081 (MST067) and the other downstream near the Blackfoot River (MST066). Sample collection at station MST069 also was considered at the toe of MWD081; however, this drainage is not connected to MST066. Therefore, MST067 was selected as a more suitable location.

Samples will not be collected in the Blackfoot River, because it would not be possible to differentiate impacts from the mine and other known upstream COPC sources. In addition, sediment samples from the ponds in the Ballard Mine area will not be collected because all of the ponds have lower quality aquatic habitat as discussed above (i.e., no Tier 1 ponds were identified at Ballard Mine during the functional use survey [IDEQ, 2004]) or no longer contain water. Tier 2 pond, MSP010, known as the Dredge Pond, was backfilled in 2009, and Tier 2 pond, MSP013, has been dry for several years.

2.2.4.2 Henry Mine

The Henry Mine was reclaimed during mining activities and has engineering controls in place to prevent erosion of the reclaimed mine dumps. It also has sediment retention features (i.e., best management practices or BMPs) in place. The opportunity for physical transport of sediment away from the mine was, and currently is, limited or non-existent. In addition, aqueous COPC/COPEC concentrations have been observed to be relatively low in surface water drainages leaving the mine area. Furthermore, sediment selenium concentrations at and in the vicinity of the mine are not consistent with sediment transport downstream of the mine. That is, there is not a pattern of higher concentrations in sediment near the mine decreasing downstream (Drawing 1). As a result, limited sediment sampling will be

conducted to confirm that downstream impacts are not present, and to help facilitate risk assessment for the same list of COPCs/COPECs that is available for soil. The objective of the sampling effort at the Henry Mine will be to sample locations where aquatic habitat is first present downstream of the mine. The stations to be sampled are listed in Table 2-2 and depicted on Drawing 1.

With the exception of the Little Blackfoot River, all of the streams in the immediate vicinity of the mine are intermittent and only flow during spring runoff. They, therefore, represent poor aquatic habitat and do not support fish, for example. Lone Pine Creek has the greatest possibility for receiving a quantity of sediment from the Site that could result in elevated COPC/COPEC concentrations. Therefore, sampling will focus on Lone Pine Creek. However, good aquatic habitat only occurs just prior to the confluence of Lone Pine Creek with the Little Blackfoot River. Therefore, one sample will be collected in the area where aquatic habitat is present at station MST053. In addition, background samples will be collected on a tributary to Lone Pine Creek at station MST275 and a spring-fed tributary above Long Valley Creek at station MST277.

Two ponds at the Henry Mine were characterized as Tier 1 ponds (i.e., associated with good aquatic habitat) during the IDEQ functional use survey (IDEQ, 2004). Both of these ponds (MSP014 and MSP016) reside in the waste rock area at the mine (Drawing 1). One pond at Henry Mine (MSP015) was characterized as a Tier 2 pond (currently used or the potential for future livestock use as drinking water). To help facilitate the ERA, sediment in these three ponds will be sampled for the same list of COPCs/COPECs identified for soil. The stations to be sampled are listed in Table 2-2 and depicted on Drawing 1.

2.2.4.3 Enoch Valley Mine

Similar to the Henry Mine, the Enoch Valley Mine was reclaimed during mining activities and has engineering controls in place to prevent erosion of the reclaimed mine dumps. In addition, BMPs are in place and are still being actively maintained and monitored for storm water permit compliance. Furthermore, with the exception of dump seep location, selenium concentrations are relatively low in stream sediment samples collected from the vicinity of the mine (see Drawing 1). As a result, limited sediment sampling will be conducted to confirm that downstream impacts are not present for COPCs/COPECs identified for soil, and to support the ERA. One sample location will be collected on Rasmussen Creek (MST131) just above the confluence with Angus Creek. This location is positioned downstream of the mine where there is suitable aquatic habitat in the stream channel. In addition, two background samples will be collected from a tributary to Rasmussen Creek at stations MST274. Angus Creek will not be sampled during this event. Angus Creek originates near the Wooley Valley Mine south of the Enoch Valley Mine. Angus Creek then flows past the Enoch Valley Mine to the south. It receives flow that originates near the Enoch Valley Mine, primarily from Rasmussen Creek. The downstream station on Rasmussen Creek that is immediately above the confluence with Angus Creek (MST131) had no selenium concentrations in sediment above the detection limit. In addition, for reasons explained in this SAP, sediment transport from the Enoch Valley Mine is not expected. As a result, because there is no indication that contamination from Enoch Valley Mine has extended to Angus Creek, P4 believes sampling is unnecessary in Angus Creek downstream of the Enoch Valley Mine.

Four ponds at the Enoch Valley Mine were characterized as Tier 1 ponds (i.e., associated with good aquatic habitat) during the IDEQ functional use survey (IDEQ, 2004). These ponds (MSP017, MSP018, MSP021, and MSP031) reside in or near the waste rock area at the mine (Drawing 1). In addition, there are two Tier 2 ponds at the Enoch Valley Mine. To help facilitate the ERA, sediment from the four Tier 1 ponds and two of the Tier 2 ponds (MSP020 and MSP023) will be sampled for the same list of COPCs/COPECs identified for soil. The stations to be sampled are listed in Table 2-2 and depicted on Drawing 1.

2.2.5 Sample Design Summary

Three-point composite samples of sediment and riparian zone soils from each bank will be collected along transects located perpendicular to the stream channel and analyzed by the methods and for the analytes listed below. An estimated three composite samples will be collected per transect in headwater locations, near the mine site, where the stream channel is narrow (i.e., less than 5 feet wide) and the riparian zone is marginal to non-existent. However, in downgradient locations, where a defined stream channel and riparian corridor exists along the stream, four composite samples will be collected per transect (two from the stream bottom and one from each bank).

A single three-point composite sediment sample (0-4 inches below ground surface [bgs]) will be collected approximately from the mid-point of the channel in narrow channels (i.e., less than five feet wide) and one riparian soil sample (0-6 inches bgs) will be collected from each of the stream banks for a total of two riparian soil samples. Each of these samples will be comprised of three grab increments that will be used for compositing the soil prior to submittal for analysis.

The composite sample from each bank will be collected perpendicular to the channel along a minimum 2-foot span beginning at the bank and continuing at 1-foot intervals until three sample increments have been collected for compositing. Should there be an obvious bench at a stream sample location; the three individual samples for compositing will be spaced evenly across the bench.

Where defined channels are wider than five feet, the channel will be divided in half, and two composite sediment samples will be collected from each half of the stream channel. These samples will be collected by grabbing three equally spaced samples from the steam bottom in each stream segment for compositing. In these locations, riparian soil samples again will be collected as described above from each of the banks for a total of four composite samples in these locations (i.e., stream channel locations wider than 5 feet).

A surface water sample also will be collected from each stream location, where flowing water is present. Surface water samples will be collected according to the methods and procedures described in the 2009 and 2010 Surface Water Monitoring Sampling and Analysis Plan (MWH, 2009a). Depending on physical conditions at each sampling location (e.g., the presence or absence of water, the presence or absence of a defined riparian zone, a scoured stream bottom with no sediment), the sample type and number will vary. For example, if upon reaching a site the field team encounters no water in the stream, but a defined channel less than five feet wide containing sediment is present, then a surface water sample would not be collected but a single sediment sample and a single riparian soil sample would be collected. Details regarding the methods and procedures to be used for the collection and analysis of stream sediment, riparian soil, and surface water samples are included in the FSP in Appendix A.

An estimated three to five sediment samples (grab or discrete samples) will be collected from approximately 0-4 inches (0-10 cm) in depth within individual ponds, depending on the size of the pond. In general, the ponds will be accessed by wading and sampled using a hand-operated sampling apparatus. One sediment sample will attempt to target the pond inlets or areas adjoining mine waste dumps, etc. in order to sample sediment from potentially the most contaminated portion of the selected ponds. At one of the sediment locations, a surface water sample will also be collected that will be representative of the pond water. Details regarding the methods and procedures to be used for the collection and analysis of pond sediment, and surface water samples are included in the FSP in Appendix A.

The sediment, riparian soil, and surface water samples will be analyzed for the metals included in the same analyte list used for the 2009 Supplemental Mine Waste Rock Dump and Facility Soil and Vegetation Characterization (MWH, 2009b), except for chromium VI (hexavalent chromium). This analyte was not detected in any of the 2009 soil samples and is unstable in neutral pH soils and, therefore, will not be collected during this sampling effort. The metals (EPA Methods 6010/6020/7471) to be sampled are the following:

- Antimony
- Arsenic
- Boron
- Cadmium
- Chromium
- Cobalt
- Copper
- Manganese
- Mercury
- Molybdenum
- Nickel
- Selenium
- Silver
- Thallium
- Uranium
- Vanadium
- Zinc

In addition, sediment samples also will be analyzed for the following:

 Acid Volatile Sulfide/ Simultaneous Extracted Metals (AVS/SEM) by Method EPA/821-R-91-100

In addition, both sediment and riparian soil samples will be analyzed for the following:

• Total Organic Carbon by Walkley-Black

Filtered surface water samples will also be analyzed for calcium and magnesium in order to calculate for dissolved hardness by Standard Methods (SM) 2340B.

2.2.6 Data Reporting

While this document is intended as a stand-alone document, this is a supplemental program associated with the overall RI/FS. The data collected as part of this program will be presented in the RI Report and utilized in the risk assessments. However, if the RI field program extends into 2011, the data will be presented in a Data Summary Report.

3.0 REFERENCES

- IDEQ, 2004. Memorandum for the Record Interagency Non-Regulated Surface Water Inspection

 Results for P4 Production's Ballard, Henry and Enoch Valley Mine Sites. From Rick Clegg,

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- MWH, 2009a. 2009 and 2010 Surface Water Monitoring Sampling and Analysis Plan, Final Revision
 2. Prepared by MWH for P4 Production, May 2009.
- MWH, 2009b. Supplemental Mine Waste Rock Dump and Facility Soil and Vegetation

 Characterization Work Plan. Prepared by MWH for P4 Production, August 2009.
- USEPA, 2006a. Guidance on Systematic Planning Using the Data Quality Objectives Process, EPA QA/G-4. U.S. Environmental Protection Agency, Washington DC, EPA/240/B-06/001, February 2006.

TABLES

	TABLE 1-1					
SUMMARY OF ANALYTICAL PARAMETERS BY MEDIUM						
	Upland Soil	Surface Water		Riparian Soil	Sediment	
Analytes		Т	D			
Antimony	X	NA	X	NA	NA	
Arsenic	X	NA	X	NA	NA	
Boron	X	NA	NA	NA	NA	
Cadmium	X	X	X	X	X	
Chromium	X	X	X	X	X	
Cobalt	X	NA	X	NA	NA	
Copper	X	NA	X	X	NA	
Manganese	X	X	X	NA	NA	
Mercury	X	NA	X	NA	NA	
Molybdenum	X	NA	X	X	NA	
Nickel	X	X	X	X	X	
Selenium	X	Х	Х	X	X	
Silver	X	NA	Х	NA	NA	
Thallium	X	NA	Х	NA	NA	
Uranium	X	NA	Х	NA	NA	
Vanadium	X	X	Х	X	X	
Zinc	X	Х	Х	X	X	

Notes:

- X This medium has been sampled and run for this metal in at least one of the mine
- T Total Fraction
- D Dissolved Fraction
- NA Never analyzed samples of this medium for this metal at any of the mines

TABLE 2-1 SEDIMENT AND RIPARIAN SOIL DQOS

Step 1 -State the Problem

Enriched concentrations of COPCs/COPECs are present in geologic materials mined from the Sites. These geologic materials have been placed in waste rock dumps. The primary process of release to the environment is oxidation, leaching, and mobilization of elements resulting in the release of elevated concentrations of COPCs/COPECs to the aqueous environment. However, soils on waste rock areas are also known to contain concentrations of COPCs/COPECs above risk-based screening levels. Erosion may transport COPCs/COPECs from the waste rock dumps into surface water features with aquatic habitat.

Previous sediment and riparian soil sampling has focused on a select list of key COPCs/COPECs (e.g., selenium and cadmium). During a RI/FS Work Plan scoping meeting, the A/T noted that some COPCs/COPECs in soils at the Sites have not been sampled in the streams (e.g., arsenic and antimony). Furthermore, if the soils were eroded from the waste rock areas into the adjacent streams, they may result in exceedances of risk-based sediment screening criteria. Therefore, the sediment pathway was not completely characterized during previous EE/CA activities.

Riparian soils may also be affected by COPCs/COPECs during high flow events that deposit stream sediment on the riparian soils. Over time, the sediment is incorporated into the soil profile.

Similarly ponds on the Sites with aquatic habitat have not been characterized for all of the COPCs/COPECs characterized in the neighboring waste rock areas. Because streams (flowing water) on the Sites are generally ephemeral, the ponds represent the most significant aquatic habitat on the Sites and will be a focus of the HHERA.

The nature and extent characterization for sediment and riparian soil needs to be sufficiently complete to allow for risk assessment (RA) and feasibility study (FS) activities. In addition, background data will be collected to allow for comparison of the existing and the new data to background.

TABLE 2-1 SEDIMENT AND RIPARIAN SOIL DQOS

Planning team, decision makers, and principal data users include P4 and the A/T.

Step 2 – Identify the Goals of the Study

Principal Study Question 1:

Are existing data sufficient to verify if soil and rock containing elevated COPC/COPEC concentrations identified during the upland soil characterization have been eroded from the Sites to downstream areas supporting aquatic habitat?

Alternative actions:

- No action. Existing data are of adequate quality and quantity to characterize stream sediments and riparian soils.
- Physical and chemical data are sufficient to indicate erosion is probably not impacting the stream sediments and riparian soils in areas of viable aquatic habitat, but not all soil COPCs/COPECs are included in the data. Therefore, confirmation sampling is needed.
- Existing data indicate that erosion and sediment transport away from the site historically occurred or currently is occurring. Therefore, additional characterization data are needed for all soil COPCs/COPECs.

Decision/estimation statement:

Decide whether sufficient data (number of COPCs/COPECs, and spatial and temporal coverage) are available to adequately characterize the nature and extent of sediment and riparian soil contamination and background calculations.

Principal Study Question 2:

Are existing data sufficient to verify if soil and rock containing elevated COPC/COPEC concentrations identified during the upland soil characterization have been eroded to or sorbed to sediments in on-site ponds that support aquatic habitat?

TABLE 2-1

SEDIMENT AND RIPARIAN SOIL DOOS

Alternative actions:

- No action. Existing data are of adequate quality and quantity to characterize pond sediments.
- Existing sampling of ponds with aquatic habitat on the Sites indicates that
 elevated COPCs/COPECs may be present in pond sediments and spatial
 coverage and numbers of COPCs/COPECs in pond sediments is not
 consistent with COPCs/COPECs observed in Site soils. Therefore,
 additional verification sampling is needed.

Decision/estimation statement:

Decide whether sufficient data (number of COPCs/COPECs, and spatial and temporal coverage) are available to adequately characterize the nature and extent of sediment impacts in on-site ponds with viable aquatic habitat. If spatial coverage is not adequate, further sampling to verify concentrations of Site soil COPCs/COPECs in pond sediments is needed.

Principal Study Question 3:

Are the data on COPC/COPEC concentrations present in sediment and riparian soil at stream and pond locations sufficient to characterize ecological risk where viable habitat exists?

Alternative actions:

- No action, existing sampling has provided adequate COPC/COPEC spatial coverage.
- 2. Existing sampling of streams and ponds with viable aquatic habitat on the Sites indicates that elevated COPCs/COPECs may be present and COPC/COPEC coverage is not consistent with COPCs/COPECs observed in Site soils. Therefore, additional sampling for the HHERA is needed

Decision/estimation statement:

Decide whether sufficient data (number of COPCs/COPECs, and spatial and temporal coverage) are available to support evaluation of risk at locations with viable aquatic habitat. If spatial coverage is not adequate, further sampling to verify concentrations of Site soil COPCs/COPECs in

TABLE 2-1 SEDIMENT AND RIPARIAN SOIL DOOS								
stream and pond sediments is needed.								
Step 3 –	The information inputs for the decision process includes the following items that may already exist or will need to be collected:							
Information Inputs	 Existing sediment and riparian soil data for 1998, 1999, 2000, 2002 and 2004 (use of existing data are dependent upon evaluations of data usability); data has been analyzed with appropriate methods for determining inorganic concentrations with detection limits suitable for comparison to risk-based screening levels. 							
	List of soil COPCs/COPECs.							
	Existing and refined conceptual site models.							
	Existing stream system and pond delineation information.							
	Developed sample location maps (Drawing 1).							
	 Existing information on aquatic habitat in area streams (i.e., RBS) and on-site ponds (i.e., aquatic functional use surveys). 							
	Background concentrations for COPCs/COPECs							
	Risk-based screening benchmarks for COPCs/COPECs.							
Step 4 –	Spatial boundaries:							
Define the Boundaries of the Study Spatial delineation of all potential source areas at Ballard, Henry, and Valley Mine areas, including:								

TABLE 2-1 SEDIMENT AND RIPARIAN SOIL DQOS

- Within stream channels supporting aquatic habitat as identified in previous studies.
- Within riparian habitat at selected stream locations.
- Within ephemeral stream channels where COPC/COPEC transport has been previously identified.
- Within on-site ponds that have viable aquatic habitat.
- Within areas upstream of sampling locations that will adequately represent background concentrations of COPCs/COPECs.

Vertical boundary:

Sediment - Maximum depth will be approximately 4 inches (0-10 cm) below the stream surface.

Riparian Soil - Maximum depth will be 6 inches below soil surface.

Temporal boundary:

Sediment and riparian soil collection is planned for late summer to fall 2010.

It is assumed that sediment and soil quality will not change during the time frame of the study.

Practical constraints:

Bedrock or other substrate conditions preventing sediment/soil sampling to depth.

TABLE 2-1 SEDIMENT AND RIPARIAN SOIL DOOS

Step 5 – Develop the Analytic Approach

Principal Study Question 1:

Where previous data suggest that transport away from the Site through the sediment migration pathway is occurring based on chemical and physical (operational) data and information, then the sediment transport pathway should be characterized to determine the nature and extent of sediment and riparian soil impacts. If available sediment and riparian soil data (existing and newly collected) are not suitable to characterize the nature and extent of impacts (lack sufficient spatial coverage, background data, or numbers of COPCs/COPECs), and do not provide a reliable estimate of potential instream sediment and riparian soil concentrations, then additional data will be collected. Otherwise the sediment data will be considered adequate for purposes of Site characterization.

Principal Study Question 2:

If available data (existing and newly collected) are not suitable to characterize the nature and extent of sediment impacts (lack sufficient spatial coverage, background data, or numbers of COPCs/COPECs) in on-site ponds with viable aquatic habitat, and do not provide a reliable estimate of potential pond sediment concentrations, then additional sediment data will be collected. Otherwise the data will be considered adequate for site characterization.

Principal Study Question 3:

If available data (existing and newly collected) are not suitable to support the HHERA (lack of sufficient spatial coverage, background data, or numbers of COPCs/COPECs) in streams and on-site ponds with viable aquatic habitat, and do not provide a reliable estimate of potential sediment and riparian soil concentrations, then additional data will be collected. Otherwise the data will be considered adequate for characterization.

Step 6 – Specify Performance

The precision, accuracy, representativeness, comparability, and completeness criteria and the minimum detection limits will be used to evaluate the usability of analytical data in making decisions about the nature and extent of soil and

TABLE 2-1 SEDIMENT AND RIPARIAN SOIL DQOS					
or Acceptance Criteria	sediment contamination at downstream locations and on-site ponds where viable habitat exists. All data must meet approved usability as defined in the RI/FS QAPP and QAPP Addendum in addition to data requirements specified in the Appendix A – the FSP.				
	Specific details of the sampling design are set forth in the plan presented herein using the considerations that have been documented.				
Step 7 – Develop the Plan for Obtaining Data	The existing sediment and riparian soil data were reviewed as part of the preparation of this SAP. The sampling rationale and design based on existing data are presented in Section 2.0 of this SAP. The sampling design will be further evaluated if new data suggests that the proposed locations and analytes are not sufficient to complete the estimation of background or the characterization of nature and extent in support of the ERA. The field methods and quality assurance requirements are presented in the FSP located in Appendix A.				

TABLE 2-2 MINE-SPECIFIC SAMPLE LOCATIONS AND RATIONALE

Station Lo	cation Sa	revious ampling Event	Sediment Se Concentration ⁽¹⁾ (mg/kg)	Rationale
------------	-----------	-----------------------------	--	-----------

BALLARD MINE STREAM AND POND SEDIMENT SAMPLING

Stream Locations					
MST095	Ephemeral trib. to	5/04	22	Immediately downstream of MWD082 and locations of observed erosion and springs and	
	Wooley Valley Creek			seeps with elevated COPC. This tributary is likely to see sediment from east side Ballard.	
MST092	Wooley Valley Creek	5/04	57	First station on Wooley Valley Creek downstream of tributary containing MST095. May	
11101002	Trooley railey creek	0,0.		receive same sediment from other portions of the Ballard Mine.	
MST089	Wooley Valley Creek	5/04	15	Downstream from MST092 on Wooley Valley Creek. Used to monitor extent of observable	
WIS 1009	vvooley valley oreck	0/04	15	sediment loading from Ballard Mine.	
MST273	Wooley Valley Creek	5/04	1.7	Downstream from MST089 on Wooley Valley Creek. Used to monitor extent of observable	
WIS1273		5/04		sediment loading from Ballard Mine.	
				Downstream from MST273 on Wooley Valley Creek and above confluence with Blackfoot	
MST272	Wooley Valley Creek	5/04	2.0	River. Last routine sampling location above the Blackfoot River with possible influence from	
				other mines.	
MCTOCC	Ephemeral tributary	E/0.4	3.2	On ephemeral tributary downstream of MWD081 at the Ballard Mine prior entering Blackfoot	
MST066	to Blackfoot River	5/04	3.2	River. Location monitors possible sediment loading from west side of the mine site.	
MST067	Ephemeral tributary	5/04	82	On ephemeral tributary near the toe of MWD081 at the Ballard Mine. This location monitors	
IVIS 1 007	to Blackfoot River	3/04	02	possible sediment loading from west side of the mine.	
MST093	Headwater of Wooley Valley Creek	5/04		Background location positioned upstream of possible Ballard Mine sediment loading impacts	
			0.072	on Wooley Valley Creek.	

TABLE 2-2 MINE-SPECIFIC SAMPLE LOCATIONS AND RATIONALE

Station ID	Location	Previous Sampling Event	Sediment Se Concentration ⁽¹⁾ (mg/kg)	Rationale
Pond Loc	ations			
None				No ponds at the Ballard Mine were identified has having a suitable quality of aquatic habitat or were used by or potentially used by livestock as a source of drinking water.
	MINE STREAM AND	POND SED	IMENT SAMPLIN	G
Stream Lo	ocations			
MST053	Lone Pine Creek	5/04	<0.50	First location on Lone Pine Creek prior to confluence with Little Blackfoot River with suitable aquatic habitat. Used to confirm COPC concentrations for ecological risk assessment.
MST275	Tributary to Lone Pine Creek	5/04	<0.60	Background location positioned outside of area of possible Henry Mine sediment and surface water loading impacts on Lone Pine Creek.
MST277	Spring-fed tributary above Long Valley Creek	5/04	0.80	Background location positioned outside of area of possible Henry Mine sediment and surface water loading impacts on Long Valley Creek.
Pond Loc	ations			
MSP014	On waste rock dump MWD085	5/04	19	Pond receiving sediment from covered waste rock dump at the Henry Mine with suitable aquatic habitat. Also receives surface water runoff from dump area.
MSP015	On waste rock dump MWD086	5/04	22	Pond receiving sediment from covered waste rock dump at the Henry Mine with potential use as a water source by livestock. Also receives surface water runoff from dump area.
MSP016	On waste rock dump MWD085	5/04	54	Pond receiving sediment from covered waste rock dump at the Henry Mine with suitable aquatic habitat. Also receives surface water runoff from dump area.

TA	BLE 2-2			
MINE-SPECIFIC SAMPLE	LOCATIONS	AND I	RATION	ALE

Station ID	Location	Previous Sampling Event	Sediment Se Concentration ⁽¹⁾ (mg/kg)	Rationale		
	VALLEY STREAM A	ND POND S	EDIMENT SAMPI	LING		
Stream Lo	ocations					
MST131	Rasmussen Creek	5/04	<0.60	On Rasmussen Creek prior to Angus Creek confluence. Potential receives sediment loading from Enoch Valley Mine and has suitable aquatic habitat.		
MST274	West Fork Rasmussen Creek	5/04	2.5	Background location, outside of the area of potential sediments impacts from the Enoch Valley Mine. Runoff from this location potentially feeds Rasmussen Creek surface water and sediment.		
Pond Loc	ations					
MSP017	On waste rock dump MWD092	5/04	34	Pond receiving sediment from covered waste rock dump at the Enoch Valley Mine with suitable aquatic habitat. Also receives surface water runoff from dump area.		
MSP018	On waste rock dump MWD092	5/04	150	Pond receiving sediment from covered waste rock dump at the Enoch Valley Mine with suitable aquatic habitat. Also receives surface water runoff from dump area.		
MSP021	On waste rock dump MWD092	5/04	23	Pond receiving sediment from covered waste rock dump at the Enoch Valley Mine with aquatic habitat. Also receives surface water runoff from dump area.		
MSP020	On waste rock dump MWD092	5/04	12	Pond receiving sediment from covered waste rock dump at the Enoch Valley Mine with potential use by livestock as a source of drinking water. Also receives surface water rule from dump area.		
MSP023	Just off waste rock dump MWD092	5/04	25	Pond receiving sediment from covered waste rock dump at the Enoch Valley Mine with potential use by livestock as a source of drinking water. Also receives surface water runoff from dump area.		

TABLE 2-2 MINE-SPECIFIC SAMPLE LOCATIONS AND RATIONALE

Station ID	Location	Previous Sampling Event	Sediment Se Concentration ⁽¹⁾ (mg/kg)	Rationale
MSP031	Just off waste rock dump MWD092	5/04	<0.60	Pond receiving sediment from covered waste rock dump at the Enoch Valley Mine with suitable aquatic habitat. Also receives surface water runoff from dump area.

Notes:

(1) - Selenium concentration in sediment from May 2004.

DRAWINGS

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APPENDICES

APPENDIX A FIELD SAMPLING PLAN AND QUALITY ASSURANCE PROJECT PLAN

SUPPLEMENTAL SEDIMENT AND RIPARIAN SOIL

FIELD SAMPLING PLAN AND QUALITY ASSURANCE PROJECT PLAN

Revision 1 FINAL

September 2010

Prepared by:

MWH AMERICAS, INC.

Prepared for:

P4 PRODUCTION, LLC

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APPENDICES

Appendix A Standard Operating Procedures

ACRONYMS AND ABBREVIATIONS

A/T Agencies and Tribes

AVS/SEM Acid Volatile Sulfides/Simultaneously Extracted Metals

AWRA Area Wide Risk Assessment

CAS Columbia Analytical Services, Inc.

cm Centimeter

COPC Contaminant of Potential Concern

COPEC Contaminant of Potential Ecological Concern

DQI Data Quality Indicator
DQOs Data Quality Objectives
DVS Data Validation Report

dw Dry Weight

EDD Electronic Data Deliverable

e.g. exempli gratia (Latin, for example)

FS Feasibility Study

FSP Field Sampling Plan

ft Feet

ft2 Square feet

GPS Global Positioning System

HHR human health risk

HASP Health and Safety Plan

IDEQ Idaho Department of Environmental Quality

i.e. id est (Latin, that is to say; in other words)

LCS Laboratory Control Sample

LCSD Laboratory Control Sample Duplicate

MDL Method Detection Limit mg/kg Milligrams per Kilogram

MWH, Inc. (formerly Montgomery Watson Harza, Inc.)

P4 Production, L.L.C.

QAPP Quality Assurance Project Plan

RBS Rapid Bioassessment Score
RPD Relative Percent Difference

RI Remedial Investigation

SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
TOC	Total Organic Carbon
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service

1.0 INTRODUCTION

This Field Sampling Plan (FSP) details the work scope for collection and analysis of sediment and riparian soil samples at P4's Ballard, Henry, and Enoch Valley Mines (the Sites). This FSP is an attachment to the Supplemental Sediment and Riparian Soil Characterization Sampling and Analysis Plan (SAP). The SAP presents the DQOs in Section 2.0 that have been developed to guide the sample collection program presented in this FSP. These documents are included in this SAP Addendum by reference and will be available for the field teams as they begin this work. In addition, QAPP components specific to the sediment and riparian soil sampling program are included herein as a part of this FSP. And a specific activity hazard analysis for health and safety considerations for sediment and riparian soil sampling is included in Appendix B of this SAP.

Complementary documents to the FSP, which are relevant to the field personnel, are the Quality Assurance Program Plan (QAPP) and QAPP Addendum, and the Health and Safety Plan (HASP) provided in Appendix D5 and Appendix E of the RI/FS Work Plan.

The FSP is organized as follows:

- Section 1 Introduction
- Section 2 Program Background and Objectives provides a brief summary
 of background information related to the need for the sediment and riparian
 soil sampling event, and objectives for the proposed sampling effort.
- Section 3 Sampling Activities includes the processes used for selection of sample locations and rationale for their selection, equipment and procedures necessary to collect samples, and decontamination procedures necessary during the field activities.
- Section 4 Sample Handling includes discussion of sample designation, handling, shipping and sample analyses (including laboratory methods to be used), and quality assurance.

- Section 5 Project Organization presents the project team, schedule, and deliverables
- Section 6 References

2.0 PROGRAM BACKGROUND AND OBJECTIVES

This section provides brief background information related to sediment and riparian soil sampling at the Sites. Additional program background and objective details are provided in Section 1.1 of the SAP, the RI/FS Work Plan, and the 2004 Site Investigation Work Plans (MWH, 2004).

The current conceptual understanding and relevant data from the three mine areas being investigated under the RI/FS are presented in Section 3.0 of the RI/FS Work Plan. Much of the work completed to date has focused on upland soil and sediment sampling, however, several of the metal analytes that were detected in soils throughout the Sites were not analyzed in sediment during the previous investigations (Refer to Table 1-1 in the SAP). Comparison of previous soil, surface water, and sediment samples revealed that some analytes (e.g., arsenic) were not collected in sediments, but were detected, in some cases, at levels above relevant screening levels in the past soil results. Therefore, the primary reason for the proposed supplemental sediment and riparian soil sampling is to fill these data gaps based on lack of specific metals data. Additional objectives for this sampling effort are provided in Section 1.1 of the SAP.

3.0 SAMPLING ACTIVITIES

Sediment and riparian soil sampling, in addition to collection of surface water samples in select locations, is proposed along riparian corridors at the Sites during the fall of 2010. The stream and pond locations proposed for this work are presented in Table 3-1 Sediment and Riparian Soil Sampling Locations. Samples of sediment and associated riparian zone soils will be collected along the stream channels and analyzed by the methods and for the analytes listed in Section 4.0. In addition, where possible, a surface water sample will be collected at each sediment location that has representative water at the time of sampling. For some of the locations along stream corridors at the Ballard Mine, surface water may not be present at the time of sampling (i.e., the stream bed is dry), and therefore, may not be collected. Pond sampling will target those water bodies that support aquatic habitat based on the 2004 Interagency Surface Water Inspection at P4 mine sites (aka, functional use survey; IDEQ, 2004) or have the potential for use as a source of water by livestock and may be impacted by surface water runoff from P4 Site operations. Sediment results from these stream and pond locations will be used to identify sediment COPECs, and their individual concentrations, for use in evaluating potential exposures to human and aquatic and/or riparian ecological receptors during the risk assessment. Samples of sediment and associated riparian zone soils will be analyzed by the methods and for the analytes discussed in Section 4.

3.1 Selection of Sampling Locations

The specific locations where the samples will be collected are presented in Table 3-1 and the rationale for selection of each sample site is presented in Table 2-2 of the SAP. This information is summarized below.

3.1.1 Locations and Rationale

Ballard Mine. Six previously sampled stream locations have been selected to assess the extent of downstream transport of sediment from the Ballard Mine. Most of the sampling will be conducted on stream locations draining the east and west sides of the mine - Wooley Valley Creek (and tributaries) and the larger western tributary to the Blackfoot River that

originated in the Site. Five locations have been selected in the Wooley Valley Creek with each successive location further downstream of the mine area (MST095, 092, 089, 273 and 272 from upstream to downstream). On the west side of the mine, the tributary stream segment is much shorter. Therefore, only two samples will be collected between the mine and the Blackfoot River (MST067 and MST066).

No sediment from ponds will be collected from the Ballard Mine because all of the ponds have lower quality aquatic habitat (no Tier 1 ponds identified during the functional use survey (IDEQ, 2004)) or no longer contain water that could potentially be used as a water source by livestock (Tier 2 ponds).

Henry Mine. With the exception of the Little Blackfoot River, all of the streams in the immediate mine area are ephemeral and only flow during spring runoff and thus represent poor aquatic habitat and do not support fish, for example. Therefore, sediment sampling will focus on Lone Pine Creek. One sample will be collected in the area where aquatic habitat is present at station MST053.

Two ponds, MSP014 and MSP016, at the Henry Mine have been characterized as Tier 1 ponds (i.e., as having good aquatic habitat) during the functional use survey (IDEQ, 2004) and will be sampled. In addition, one Tier 2 pond (MSP015) also will be sampled as the pond has the potential for use as a water source by livestock.

Enoch Valley Mine. One sample location will be collected on Rasmussen Creek (MST131) just above the confluence with Angus Creek. This location is positioned downstream of the mine site where there is suitable aquatic habitat in the stream channel.

Four ponds, MSP017, MSP018, MSP021, and MSP031, at the Enoch Valley Mine have been characterized as having as being Tier 1 ponds (i.e, good aquatic habitat) during the functional use survey (IDEQ, 2004) and will be sampled. In addition two of the four Tier 2 ponds, MSP020 and MSP023, also have been selected to be sampled based on their potential for use as a water source by livestock.

3.1.2 Background Areas

Background stations also will be sampled for surface water, sediment, riparian soil, and these stations are noted in Table 3-1 and depicted on Drawing 1. A total of eight background sample locations will be collected as follows:

- Two on Wooley Valley Creek above any influence from the Site (MST093)
- Two on a tributary to Lone Pine Creek at station MST275 above any influence from the Sites
- Two on a tributary to Rasmussen creek at station MST7274 above any influence from the Sites
- Two on a spring-fed tributary above Long Valley Creek at station MST277
 in an area that is not influenced by the Sites

3.2 Sample Collection Procedures

This section presents the site access, equipment, and procedures for the collection, handling, and analysis of each sampled medium. Samples will be analyzed according to the methods in Table 3.2. Where applicable, references to SOPs are provided.

3.2.1 Site Access, Logistics and, Safety

P4 has access to all source areas and background areas. The A/T will be notified, at minimum, five business days prior to commencement of field activities. The MWH On-Site Safety Officer will notify the P4 Project Manager (Barry Koch) at minimum three days prior to working at a mine area. Such notification is necessary to arrange for any company-specific safety training, and if necessary, to arrange for a company representative to accompany the crew to provide access through locked gates.

Field equipment and samples will be stored at the Fox Hills Machine Shed, owned by P4. Equipment, supplies, and samples will be shipped and received from the Monsanto plant, in Soda Springs, in care of Barry Koch, P4. Additional sample handling and shipping information is presented in Section 4.2.

Safety procedures for the site investigation are described in the HASP located in Appendix E of the RI/FS Work Plan and in the Activity Hazard Analysis for this Program (Appendix B of the SAP). Enoch Valley Mine has its own safety requirements that will be followed by field personnel when working in, or traveling through, active areas of the site. The mine-specific safety requirements involve a short training orientation for hazard recognition and avoidance. In the event that P4's corporate safety policy is stricter than the requirements of the HASP, those corporate safety requirements will take precedence.

3.2.2 Equipment and Procedures

Equipment and procedures for sediment sampling vary considerably when comparing stream corridor locations with pond locations. Below, are descriptions of the procedures that will be followed for sediment sampling at streams and in ponds, in riparian areas, and surface water sampling.

Stream Sediment. Three-point composite sediment samples will be collected at the specific stream monitoring stations listed in Table 3-1. Samples of sediment will be collected along transects located perpendicular to the stream channel and individual grab samples that will be used for compositing will be collected from 0-4 inches below the surface of the sediment. One three-point composite_sediment sample will be collected per transect in headwater locations, where the stream channel is narrow (less than 5 feet wide)_and the riparian zone is marginal to non-existent. However, in downgradient locations, where a defined stream channel greater than 5 feet wide and riparian corridor exists along the stream, two composite sediment samples will be collected per transect, depending on the physical conditions at each location.

The three sediment samples for compositing will be collected approximately from the midpoint of the narrow channels (i.e., less than 5 feet wide). Where the channels are wider than five feet, the channel will be divided in half, and two composite sediment samples will be collected from each half of the stream channel. These samples will be collected by grabbing three equally spaced samples from the steam bottom in each stream segment for compositing.

Sediment samples will be collected from the top approximately four inches of the sediment column. Each sample will be a composite of three increments (e.g., three discrete grab samples). The three sample increments will be collected using a stainless steel or polyethylene scoop and each will be retained in a plastic bag prior to compositing. To help prevent bags from ripping, large debris will be removed and shaken lightly to dislodge sediment that has adhered to the surface of the debris, then discarded before the remaining sediment is placed into the stainless steel bowl for mixing. The three sample increments will be mixed in a stainless steel bowl. After mixing, each composite sediment sample will be placed in a heavy duty, 1-gallon Ziploc® storage bag or sample container. These composite samples, at a minimum, will be double-bagged to prevent leakage and excess air will be purged from the bags to prevent bursting during transport.

Sediment samples will be labeled and handled following the sample handling protocols described in Section 4.0. Detailed sediment sampling protocols are outlined in SOP-NW-9.3, *Collection of Sediment Samples*. This SOP is located in Appendix A.

Pond Sediment. Pond sediment samples will be collected at the monitoring stations listed in Table 3-1. At each sediment sample location, sediment will be collected from the top approximately four inches of the sediment column. An estimated three to five composite surface sediment samples will be collected at each pond location depending on the size of the pond as described below.

- Ponds <0.5 acres 3 sediment samples collected
- Ponds between 0.5 and 3 acres 4 sediment samples collected
- Ponds > 3 acres 5 sediment samples collected

In general, the ponds will be accessed by wading and sampled using a dredge sampling apparatus or similar. Pond inlets, areas adjoining mine waste dumps, etc. will be targeted for

the initial sample in each pond, in an attempt to collect sediment from the most impacted portion of the selected ponds. The other samples will be distributed at approximately equal intervals across the pond.

Personnel will collect sediment samples using a petite-Ponar dredge or similar. The approximately top four inches of each Ponar dredge sample will be removed from the dredge and placed in a stainless steel or polyethylene bowl. Each pond sediment sample will be a composite of three increments (e.g., three discrete grab samples). In some ponds, it may be possible to collect the three sample increments using a stainless steel or polyethylene scoop. No matter how the individual grab samples are collected, they will be held in bags for compositing. The larger debris will be removed from each sample that is collected and will be shaken lightly to dislodge adhered sediments (that have adhered to the surface of the debris) into the bowl, then discarded before the sediment is composited using a stainless steel spoon. Once compositing is complete, the sediment will be placed into sample containers or heavy duty, 1-gallon Ziploc* storage bags. These samples, at a minimum, will be double bagged to prevent leakage and excess air will be purged from the bags to prevent bursting during transport.

Samples will be labeled and handled following the sample handling protocols described in Section 4.0. Sediment samples will be collected using the protocols for collection of sediments in ponds is outlined in SOP-NW-9.3, *Collection of Sediment Samples*. This SOP is located in Appendix A.

Riparian Soil. Where sediment samples are collected, riparian soil samples also will be collected from each stream bank. Riparian soils are defined as sediments deposited within the riparian zone (interface between land and the stream) and are often deposited during higher water/flood conditions in the spring. The riparian soil samples will be collected from each bank (e.g., the depositional bank and the erosional bank) regardless of whether the defined stream channel is great than or less than 5 feet in width.

The composite sample from each bank will be collected perpendicular to the channel along a minimum 2-foot span beginning at the bank and continuing at 1-foot intervals until three

sample increments have been collected for compositing. Each sample increment will be collected from 0–6 inches below ground surface. Should there be an obvious bench at a stream sample location; the three individual samples for compositing would be spaced evenly across the bench.

Individual riparian grab samples will be collected by carefully removing the top layer of soil to the desired sample depth with a decontaminated spade, shovel, or equivalent. Compositing of the riparian soil grab samples will be similar to the sediment samples as described above. Larger debris will be removed from each sample that is collected prior to mixing. The composite riparian soil will be mixed in the stainless steel bowl, then placed in a sample container or heavy duty, 1-gallon Ziploc® storage bag.

Riparian soil samples will be labeled and handled following the sample handling protocols described in Section 4.0. Soil samples will be collected using the protocols outlined in SOP-NW-7.2, *Collection of Soil Samples*. This SOP is located in Appendix A.

Surface Water. One surface water sample also will be collected from each pond (co-located with one of the sediment locations) and a surface water sample will be collected from each stream location where flowing water is present. Surface water samples will be collected according to the methods and procedures from the 2009 and 2010 Surface Water Monitoring Sampling and Analysis Plan (MWH, 2009a). It is important to note that six of the proposed sediment and riparian sample stations (MST066, MST089, MST092, MST093, MST095, and MST131) are part of the 2009-2010 Surface Water Monitoring SAP and previously have been sampled using that approved plan.

Surface water samples will be collected using the protocols outlined in SOP-NW-9.1, Collection of Surface Water Samples from the 2009-2010 Surface Water Monitoring SAP. This SOP has been copied and is provided Appendix A to this FSP. Details of surface water flow measurement methods are presented in SOP-NW-9.2a, Surface Water Flow Measurements Using Man-Made Portable Devices or Estimation Techniques, which is located in Appendix A.

3.2.3 Equipment Decontamination

Equipment used for collecting samples will be decontaminated prior to all sample acquisition activities. Sampling equipment will be cleaned and decontaminated prior to use and rinsed between each sampling location. Equipment will be decontaminated as follows:

- Remove excess rock fragments, soil, sediment, and vegetation
 - Wash the equipment in low- with Crystal White™ (or non-phosphate detergent (e.g., Alconox® equivalent) biodegradable soap/deionized water solution
 - Rinse with potable water
 - Rinse twice with deionized or distilled water
 - Rinse water will be discarded to the ground away from surface water features

In addition, between sample locations, at a pond or station, the sampling equipment will be rinsed or scrubbed to the extent necessary to remove all sediment that may have adhered to the sampling equipment. This may be conducted using potable water or water from the sampling location (e.g., pond water).

All rinsate may be disposed of onsite. Field personnel will handle field equipment and containers carefully to minimize the potential for cross-contamination. Containers will be handled in a manner to prevent direct contact with internal surfaces. Sampling personnel will avoid wearing items or clothing that may interfere with dexterity or create a potential source for cross contamination.

4.0 SAMPLE HANDLING

4.1 Sample Designation

Samples will be labeled with all necessary information on laboratory supplied labels using waterproof ink. Pre-printed labels will contain the following information:

- Site location
- Sample identification
- Method of preservation, if used
- Sample matrix

The date and time of sample collection and sampler's initials will be added to the label at time of collection.

Each sample will be assigned a unique identification number. This number will be coded according to sample location according to the following format for sediment and riparian soil:

AABB-MXXxxx-YY-ZZZ-c

where:

- AA indicates the year (two digits) the sampling event started
- **BB** indicates the month (two digits) the sampling event started
- **M** designates "M" for Monsanto and is used to differentiate from other sample stations identified by MWH for Idaho Mine Association (IMA) mine-specific investigations.

• XX denotes the station type, as follows:

ST - Stream Location

SP – Site Pond Location

- xxx denotes the specific three-digit station number/location
- YY denotes media type; media types are as follows:
 - SD: Sediment
 - RS: Riparian Soil
- **ZZZ** denotes the sample number for the media type (in ascending order)
- c denotes the replicate number 1, 2, as necessary.

For example, sample number **1009-MST066-SD-001** describes the first sediment sample collected from stream location MST066 in September 2010.

Each surface water sample shall be assigned a unique identification number. This number shall be coded according to sample location according to the following format:

AABB-SW-MYYaaa-b-c

where:

- AA indicates the year (two digits) the sampling event started
- BB indicates the month (two digits) the sampling event started
- **SW** denotes that surface water is sampled.

- M designates "M" for Monsanto and is used to differentiate from other sample stations identified by MWH for Idaho Mine Association (IMA) mine-specific investigations.
- YY denotes the station type; station type which is ST for streams.
- aaa denotes the specific station number/location.
- **b** denotes whether the sample involved special field handling or is to be handled in a specific manner; handling codes are as follows:

F: Filtered U: Unfiltered

 \mathbf{c} denotes the replicate number (-blank shall indicate no replicate samples; if there are QA/QC replicate samples, then 1 and represent the replicate samples.

As an example, sample number 1010-SW-MST066-F describes a non-replicated, filtered surface water sample collected at stream monitoring station MST066.

For equipment rinsate samples, the number will be identified as AABB - ER - ZZ - bb

AA: Indicates the year (two digits) the sampling event started

BB: Indicates the month (two digits) the sampling event started

ER: Equipment Rinsate

ZZ: Media type (sediment, riparian soil, surface water)

bb: Rinsate number (01, 02, 03,.... etc.)

If multiple field teams are generating blanks on the same day, each team will be assigned unique numbers or a range of numbers prior to sampling.

4.2 Sample Handling and Shipping

Sample containers will be sealed in plastic bags with wire ties and immediately placed on ice in an insulated cooler to ≤ 6 °C. Insulated coolers will be provided by the contract laboratories or purchased locally. All samples will be stored in the coolers and handled as specified in the QAPP and QAPP Addendum. All samples will remain in the coolers until

the end of the day when all of the samples will be placed in a locked refrigerator at the Fox Hills Ranch.

Samples will be shipped to the laboratories with blue ice or bagged wet ice in coolers with custody seals placed on the outside of the coolers. They will be secured with packing tape, via overnight Federal Express service to the appropriate laboratory. If possible, only one type of medium will be shipped in each cooler. MWH will fill out appropriate chain-of-custody forms supplied by the respective laboratory. The chain-of-custody will be included with the sample shipment, and copies of all chains-of-custody along with Federal Express waybills will be kept by MWH field personnel.

All samples will be sent to Columbia Analytical Services, Inc. (CAS) at the following address:

Columbia Analytical Services, Inc.

1317 S. 13th Ave

Kelso, WA 98626

(360-) 577-7222 (office)

www.caslab.com

Attn: Greg Salata

Supplies including sample containers and coolers will be sent to the Monsanto Plant:

Monsanto Company

1853 HWY 34

Soda Springs, ID 83276

(208) 547-1439

Attention: Barry Koch

4.3 Sample Analysis

The target analyte list for sediment, riparian soil, and surface water samples collected during this field program is the same as that used for the 2009 Supplemental Mine Waste Rock Dump and Facility Soil and Vegetation Characterization (MWH, 2009b) with the exception of chromium VI (hexavalent chromium). Chromium VI was not detected in any of the 2009 soil samples,

is unstable in neutral pH soils which are found at the Sites, and therefore will not be run during laboratory analysis. Additionally, soil and sediment samples will be analyzed for total organic carbon (TOC), and sediment samples will be analyzed for acid volatile sulfide/simultaneously extracted metals (AVS/SEM).

The analytical methods are as follows:

- Antimony, boron, manganese, molybdenum, and zinc by EPA Method 6010B (and calcium and magnesium to obtain hardness calculation for surface water samples only)
- Arsenic, cadmium, chromium, cobalt, copper, nickel, selenium, silver, thallium, uranium, and vanadium by EPA Method 6020A
- Mercury by EPA Method 7470A (water) or 7471A (soil and sediment)
- Acid Volatile Sulfide/ Simultaneous Extracted Metals (AVS/SEM) Metals (sediment only)
- Total Organic Carbon (soil and sediment only)
- Dissolved hardness by Standard Methods (SM) 2340B

Table 4-1 summarizes the target analyte list and CAS's method detection limits (MDLs) and reporting limits (RLs). Table 4-2 summarizes the samples to be collected and analytical laboratory and field methods to be performed.

Table 4-3 provides the detailed data quality indicators (DQIs) for the project. The project human health risk (HHR) screening levels for soil and surface water are listed on Tables 4-4 and 4-5, respectively. The project-specific ecological screening levels for riparian soil, sediment, and surface water are listed on Tables 4-6 through 4-8, respectively. All laboratory reporting limits are less than the screening levels with the following exceptions:

- Arsenic in soil for HHR (Table 4-4)
- Antimony and arsenic in surface water for HHR (Table 4-5)
- Antimony, boron, and selenium in soil for ecological risk (Table 4-6)

4.4 Field and Laboratory Quality Control Samples

The project-specific quality assurance plan for this sampling event is based on the procedures established in the Part 2 (the Quality Assurance Program Plan) of the Comprehensive Site Investigation Sampling and Analysis Plan (MWH, 2004); the matrix-specific requirements provided in the QAPP portion of the Supplemental Mine Waste Rock Dump and Facility Soil and Vegetation Characterization (MWH, 2009b) for soil and sediment samples; and the matrix-specific requirements provided in the QAPP Addendum (MWH, 2009a) for surface water sediment samples.

Field duplicates for each matrix will be collected at a rate of 10 percent of the number of primary samples, and matrix spike and matrix spike duplicate pairs will be collected at a rate of five percent of the number of primary samples. One equipment rinsate will be collected each day if there is shared equipment and therefore a chance to cross-contaminate. In the instances where equipment rinsates need to be collected, one source water sample will be collected for the field event.

The relative percent difference (RPD) will be calculated for all values are greater than their reporting limits. The data users will take into account the field replicate variability when assessing trends and/or decisions made with respect to field sample results. For riparian soil and sediment, variability associated with the duplicate results will be a reflection of obvious variability associated with the material being sampled, as well as any inherent variability in the sampling and analysis of the tested material. Therefore, the precision of duplicate samples will be used to document this variability but will not be used to assess data usability with respect to comparisons of sample results to screening values. Variability for results in surface water is not expected, so the RPD acceptance criterion is less than or equal to 25. Field sample results associated with RPDs greater than 25 will be evaluated for impact on data usability.

Laboratory quality control samples and their requirements are detailed on Tables 4-9 through 4-11 for EPA Methods 6020A, 6010B/C, and 7470A/7471A, respectively. TOC in soil and sediment will be analyzed the Walkley-Black method. The Walkley-Black method is

titrimetric method, for which there is no initial or continuing calibration requirements. The acceptance criteria for TOC laboratory control sample (LCS) and laboratory control sample duplicate (LCSD) analysis are 85 to 115 percent recovery and an RPD of 20.

4.5 Data Validation

The following definitions are provided in *Guidance for Quality Assurance Project Plans* (USEPA, 2002):

- Verification the process of evaluating the completeness, correctness, and conformance/compliance of a specific data set against the method, procedural, or contractual specifications.
- Validation an analyte- and sample-specific process that extends the evaluation of data beyond method, procedural, or contractual compliance (i.e., data verification) to determine the analytical quality of a specific data set.

Based on these definitions, the 3rd-party validator will be performing data verification of the sample, calibration, and QC data provided by the laboratory against the criteria specified in this project-specific QAPP. The validator will use the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (USEPA, 2004) as a basis for performing data verification and qualification of data. Where appropriate, specific references to the USEPA Functional Guidelines, as well as additional detail and/or deviation from that guidance, is detailed for EPA Methods 6020A, 6010B/C, and 7470A/7471A on Tables 4-9 through 4-11, respectively. The validator will document the data verification process on their in-house worksheets and summarize the results in data validation reports. Data validation reports will be consistent with the templates provided in the Supplemental Ming Waste Rock Dump and Facility Soil and Vegetation Characterization QAPP (MWH 2009b).

The validator will use the following data qualifiers ("USEPA Flag"):

U The analyte was analyzed for, but was not detected above the level of the reported sample quantitation limit.

- J The result is an estimated quantity. The associated numerical value is the approximated concentration of the analyte in the sample.
- J+ The result is an estimated quantity, but the result may be biased high.
- J- The result is an estimated quantity, but the result may be biased low.
- R The result is unusable. The sample result is rejected due to serious deficiencies in meeting quality control criteria. The analyte may or may not be present in the sample.
- UJ The analyte was analyzed for, but was not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise.

And the following "Reason Codes":

- 1 Holding Time
- 2 Sample Preservation (including receipt temperature)
- 3 Sample Custody
- 4 Missing Deliverable
- 5 ICPMS Tune
- 6 Initial Calibration
- 7 Initial Calibration Verification
- 8 Continuing Calibration Verification
- 9 Low-Level Calibration Check Sample
- 10 Calibration Blank
- 11 Laboratory or Preparation Blank
- 12 ICPMS or ICP Interference Check Standard
- 13 Laboratory Control Sample or Laboratory Control Sample Duplicate Recovery
- 14 Laboratory Control Sample Precision
- 15 Laboratory Duplicate Precision
- 16 Matrix Spike or Matrix Spike Duplicate Recovery
- 17 Matrix Spike/Matrix Spike Duplicate Precision
- 18 ICPMS or ICP Serial Dilution
- 19 ICPMS Internal Standard
- 20 Field Replicate Precision
- 21 Equipment Rinsate Blank
- 22 Linear Range Exceeded
- 23 Other reason

The validator will populate an MWH-supplied electronic data deliverable (EDD) with the following data:

- Field Header "USEPA Flag": Populate with USEPA flags specified above and in template reports.
- Field Header "Reason Code": Populate with all applicable Reason Codes as specified above and in template reports.
- Field Header "Final Result": Populate with the final, qualified result, including any adjustment based on blank contamination.

The validator will perform USEPA Stage 2B verification/validation (USEPA, 2009) on approximately 90 percent of sample data and USEPA Stage 4 verification/validation on the remaining 10 percent of sample data.

The MWH Program Quality Manager will take the lead on validating the verified data. Data will be tabulated and assessed against the screening values. The reporting limits associated with non-detected values will be reviewed against the screening limits to evaluate whether the reported results are sufficiently sensitive as compared to the screening values. Results that are estimated (J+ or J-) will be assessed for impact on data usability. Rejected results, as well as any sample that could not be collected or analyzed for any reason, will be evaluated, and a data-gap assessment will be performed and documented in the report.

5.0 PROJECT ORGANIZATION

5.1 Project Team

Figure 8-1 of the RI/FS Work Plan presents the organization of the entire RI/FS project team. Contact information for each member of the project team is presented below in Table 5-1. The field team leader will submit a daily update to P4 and MWH project and task managers that contains a report of daily progress, any variances from planned work for the day, anticipated work for the next day, and any other problems or assistance required. A weekly update will be submitted to the A/T on-scene coordinator. All updates will be submitted via e-mail.

5.2 Project Schedule

- Sediment and Riparian Soil Sampling (1 event) Between August 31 and October 31, 2010
- Data validation within 60 days of receipt of laboratory data

5.3 Project Deliverables

While this document is intended as a stand-alone document, this is a supplemental program associated with the overall RI/FS. The data collected as part of this program will be presented in the RI Report and utilized in the risk assessments. However, if the RI field program extends into 2011, the data will be presented in a Data Summary Report. The raw data and data validation reports will be submitted to the A/T upon request when available. A data validation summary (DVS) will be submitted to the A/T within 90 days from the date of collection of the last sample from each sampling event. The report prepared will describe (e.g., narrative of results, field activity and data summaries, statistical analysis) and display (tables, graphs, figures, drawings, maps, etc.) the location, dimensions, physical condition, and varying concentrations of each contaminant for each source and the known extent of contaminant migration through each of the affected media. Concentrations of surface water

and equipment rinsate blank samples will be expressed in terms of weight per unit volume (mg/L) for metals. Concentrations of solid matrices (soil and sediment samples) will be expressed in terms of weight per unit weight of the dried sample from each sampling event (mg/kg dw) for metals. The number of significant figures in the field and laboratory data presented in the final report will be consistent with the limits of uncertainty inherent in the measurement or analytical method. For the derivation of preliminary, risk-based benchmark concentrations, results are reported to one significant figure. Therefore, two significant figures will be retained for inputs to the risk model to minimize rounding error.

6.0 REFERENCES

- IDEQ, 2004. Memorandum for the Record Interagency Non-Regulated Surface Water Inspection Results for P4 Production's Ballard, Henry and Enoch Valley Mine Sites. From Rick Clegg, IDEQ, to Robert Geddes, P4, June 23, 2004, 14 p.
- MWH, 2004. Comprehensive Site Investigation Selenium Program, Sampling and Analysis Plan Final.

 Southeast Idaho Mine-Specific Selenium Program. April.
- MWH. 2009a. Final Quality Assurance Project Plan Addendum, Revision 2. May.
- MWH, 2009b. Supplemental Mine Waste Rock Dump and Facility, Soil and Vegetation Characterization. Quality Assurance Project Plan. Revision 3. Final. August 18.
- United States Environmental Protection Agency (USEPA), 2002. Guidance for Quality

 Assurance Project Plans. EPA/240/R-02/009. Prepared by the USEPA Office of Environmental Information, Washington, DC. December.
- USEPA, 2004. USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review. EPA 540-R-04-004. Prepared by USEPA Office of Superfund Remediation and Technology Innovation, Washington, DC. October.
- USEPA, 2009. Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use. EPA 45-R-08-005. Office of Solid Waste and Emergency Response. January 13.

TABLES

TABLE 3-1					
SEDIMENT	AND	RIPARIAN	SOIL	SAMPLING	LOCATIONS

Station Number	Feature	Sampling Station	Location		
Hamber	reature	Sampling Station	Latitude	Longitude	
MST066	Ephemeral tributary to Blackfoot River	Above Blackfoot River	N42° 48' 56.30"	W111° 30' 07.32"	
MST067	Ephemeral tributary to Blackfoot River	Below Ballard Mine	N42° 49' 26.29"	W111° 29' 30.30"	
MST089		Below North Fork Wooley Valley Creek	N42° 49' 29.00"	W111° 26' 20.00"	
MST273	Wooley Valley Creek	Above Ponding and Below MST089	N42° 49' 08.02"	W111° 25' 41.02"	
MST272		Above Loadout Creek at Road	N42° 48' 03.97"	W111° 24' 40.99"	
MST092	Wooley Valley Creek	Above North Fork Wooley Valley Creek	N42° 49' 40.00"	W111° 27' 04.00"	
MST093*	Headwater of Wooley Valley Creek	Above Ballard Mine	N42° 50' 25.34"	W111° 28' 32.89"	
MST095	Ephemeral trib. to Wooley Valley Creek	Below Ballard Mine	N42° 49' 38.89"	W111° 28' 05.02"	
MST053	Lone Pine Creek	Above Little Blackfoot River	N42° 54' 26.02"	W111° 28' 32.61"	
MST274*	Tributary to Rasmussen Creek	Above Rasmussen Creek	N42° 51' 31.00"	W111° 23' 34.00"	
MST275*	Tributary to Lone Pine Creek	Northeast and above East Fork Lone Pine Creek	N42° 51' 56.33"	W111° 25' 04.24"	
MST277*	Spring-fed tributary above Long Valley Creek	Northwest of the Henry Mine above Long Valley Creek	N42° 51' 52.20"	W111° 29' 04.20"	
MST131	Rasmussen Creek	Above Angus Creek	N42° 51' 08.00"	W111° 22' 31.00"	
MSP014		Henry Mine Henry Pond (5.8 acres)	N42° 52' 17.85"	W111° 27' 39.15"	
MSP015		Henry Mine Henry Pond (1.28 acres)	N42° 53' 09.79"	W111° 28' 39.81"	
MSP016	1	Henry Mine Center Henry Pond (0.71 acres)	N42° 53' 23.25"	W111° 28' 53.93"	
MSP017	Ponds	Enoch Valley Mine South Pond (2.69 acres)	N42° 52' 01.17"	W111° 23' 30.78"	
MSP018		Enoch Valley Mine Keyhole Pond (<0.10 acres)	N42° 52' 08.96"	W111° 23' 51.57"	
MSP020		Enoch Valley Mine (3.99 acres)	N42° 52' 23.23"	W111° 24' 26.81"	

	SED	TABLE 3-1 IMENT AND RIPARIAN SOIL SAMPLING LOCATION	s	
Station Number	Feature	Sampling Station	Loc	ation
			Latitude	Longitude
MSP021		Enoch Valley Mine Stock Pond (1.62 acres)	N42° 52' 31.69"	W111° 24' 19.85"
MSP023		Enoch Valley Mine (0.64 acres)	N42° 52' 42.12"	W111° 25' 20.00"
MSP031		Enoch Valley Mine Shop Pond (0.3 acres)	N42° 52' 34.40"	W111° 25' 11.40"

Note: *Background Station

REQUIREMENTS FOR SAMPLE CONTAINERS, VOLUMES, PRESERVATION, AND HOLDING TIMES

Parameter(s)	Analytical Method	Sample Container	Preservation	Holding Time
Soil/Sediment Sam	ples			
ICPMS Metals	6020A			6 months
ICP Metals	60210B/C		Cool to ≤ 6 °C for mercury (other ——	6 months
Mercury	7471A	2 x 16-ounce glass jar	metals not required to be cooled)	28 days
AVS/SEM	EPA-821-R-91-100		metals not required to be cooled) ——	14 days
тос	Walkley-Black			28 days
Surface Water Sam	ples			
ICPMS Metals	6020A	1 x 500 mL poly (unfiltered)	pH < 2 with nitric acid	6 months
ICP Metals	60210B/C	1 x 500 mL poly (unfiltered)	pH < 2 with nitric acid	6 months
Mercury	7470A	1 x 500 mL poly (unfiltered)	pH < 2 with nitric acid; cool to ≤ 6 °C	28 days
Equipment Rinsate	Blank Samples (Water)			
ICPMS Metals	6020A	1 x 500 mL poly (unfiltered)	pH < 2 with nitric acid	6 months
ICP Metals	60210B/C	1 x 500 mL poly (unfiltered)	pH < 2 with nitric acid	6 months
Mercury	7470A	1 x 500 mL poly (unfiltered)	pH < 2 with nitric acid; cool to ≤ 6 °C	28 days

AVS/SEM - acid volatile sulfides/simultaneously extractable metals

ICP - inductively coupled plasma-atomic emission spectrometry

ICPMS - inductively coupled plasma-atomic emission spectrometry/mass spectrometry

mL - milliliters

°C - degrees Celsius

TOC- total organic carbon

TABLE 4-1

Target Analyte List, MDLs, and RLs for Riparian Soil/Sediment and Surface Water

			diment		e Water
	Analytical	MDL	RL	MDL	RL
Parameter	Method	(mg/kg)	(mg/kg)	(mg/L)	(mg/L)
Metals					
Antimony	EPA 6010B	3	10	0.003	0.010
Arsenic	EPA 6020A	0.06	0.5	0.0001	0.0005
Boron	EPA 6010B	0.4	10	0.002	0.010
Cadmium	EPA 6020A	0.004	0.02	0.00002	0.000005
Chromium	EPA 6020A	0.03	0.2	0.00004	0.0002
Cobalt	EPA 6020A	0.003	0.02	0.00002	0.000006
Copper	EPA 6020A	0.08	0.1	0.00002	0.0001
Manganese	EPA 6010B	0.04	2	0.0002	0.0006
Mercury	EPA 7471A/7470A	0.002	0.02	0.00002	0.0005
Molybdenum	EPA 6010B	0.5	2	0.0006	0.020
Nickel	EPA 6020A	0.03	0.2	0.00003	0.001
Selenium	EPA 6020A	0.2	1	0.0003	0.001
Silver	EPA 6020A	0.008	0.02	0.000004	0.00002
Thallium	EPA 6020A	0.003	0.02	0.000005	0.00002
Uranium	EPA 6020A	0.006	0.02	0.000003	0.00002
Vanadium	EPA 6020A	0.02	0.2	0.00003	0.0002
Zinc	EPA 6010B	0.3	2	0.0007	0.020
Other					
TOC	Walkley-Black	0.07%	0.2%	na	na
AVS/SEM:	EPA-821-R-91-100				
Cadmium	EPA 6020A	nd	0.2	na	na
Copper	EPA 6020A	nd	0.4	na	na
Lead	EPA 6020A	nd	3	na	na
Mercury	EPA 7471A	nd	0.01	na	na
Nickel	EPA 6020A	nd	0.5	na	na
Zinc	EPA 6020A	nd	0.4	na	na

AVS/SEM - acid volatile sulfides/simultaneously extractable metals

MDL - method detection limit

mg/kg - milligrams per kilogram

mg/L - milligrams per liter

na - not applicable

nd - not determined

RL - reporting limit

TOC - total organic carbon

SAMPLES TO BE COLLECTED SOIL, SEDIMENT, AND SURFACE WATER (Page 1 of 6)

				•			Analyti	cal Lat	oora	tory Pa	ramet	er (Me	tho	d)					Fie	id Pa	arame	ter			_
Field Sample Identification	Location	Mine	Matrix	Filtered/ Unflitered	QC Sample Type	Total Selenium (EPA 6020A)	Dissolved As, Cd, Cr, Co, Cu, NI, Ag. Tr, U, V (EPA 6020A)	Dissolved Sb, B, Ca, Mg, Mn, Mo, Zn (EPA 6010B)	Dissolved Mercury (7470A)	Dissolved Hardness (SM2340B-Calc)	Total As, Cd, Cr, Co, Cu, NI, Se, Ag. TI, U, V (EPA 6020A)	Total Sb, B, Mn, Mo, Zn (EPA 6010B)		AVS/SEM	TOC (Walkley-Black)	Conductivity (uS/cm)	Specific Conductivity (uS/cm)	H	Dissolved Oxygen (% sat)	Dissolved Oxygen (mg/L)	Oxidation/Reduction Potential (mV)	Turbidity (ftu)	Water Temperature (°C.)	Air Temperature (°C)	Discharge (ft²/sec)
1010 0111107000 5 1	T		Lydratas	F:though	0		· ·		_	· ·				_		ΤV	τv	· ·	VΤ	VΙ		×	ХĪ	хI	<u>~</u>
1010-SWMST066-F-1	MST066	Ballard	Water Water	Filtered	Primary	×	×	X	×	X	<u> </u>		\vdash	Н	Н	X	X	X		X	X	X	_		×
1010-SWMST066-U-1	MST066	Ballard	Water	Unfiltered	Primary	 ^- -	X	×	x	X			\vdash			l ŝ	Î	x		श ी	$\frac{\hat{x}}{x}$	x		_	슀
1010-SWMST066-F-2	MST066	Ballard		Filtered	Duplicate	├	 ^		ŀ		_		\vdash		\vdash	l ŝ	÷	Ŷ	$\overline{}$	쉯	^	 		_	싌
1010-SWMST066-U-2	MST066	Ballard	Water	Unfiltered	Duplicate	X	—		\vdash		├ ु		l.	х	 	╀	ŀ	Ĥ	\rightarrow	4		^		솼	싁
1010-MST066-SD-001-1	MST066	Ballard	Sediment	NA NA	Primary	ļ			\vdash		X	X	X		X	╄	1	\vdash	\dashv	-1		Н	_	_	-
1010-MST066-SD-001-2	MST066	Ballard	Sediment	NA	Duplicate	ļ			\vdash		X	X	X	х	X	+			\rightarrow	_		$\vdash \vdash$		X	4
1010-MST066-RS-001-1	MST066	Ballard	Soil	NA	Primary						X	X	X	Ш	X	╄	₩	Н	\dashv	-				×	
1010-MST066-RS-001-2	MST066	Ballard	Soil	NA	Duplicate				Ш		X	X	X	_	X	╄				-		Ш		X	_
1010-MST066-RS-002	MST066	Ballard	Soil	NA	Primary				L.		X	Х	X		X	 	١							X	ᆜ
1010-SWMST067-F-1	MST067	Ballard	Water	Filtered	Primary		X	Х	X	X			Ш		Ш		X			X	Х	X			X
1010-SWMST067-U-1	MST067	Ballard	Water	Unfiltered	Primary	X	L								Ш	<u> X</u>	Х	X	Х	X	Х	X	_	_	X
1010-MST067-SD-001-1	MST067	Ballard	Sediment	NA	Primary				Ш		X	X	X	Х	_	┺	┖			_		Ш		X	_
1010-MST067-RS-001-1	MST067	Ballard	Soil	NA	Primary						X	Х	X		X	_	┖		_			\sqcup		X	_
1010-MST067-RS-002	MST067	Ballard	Soil	NA	Primary		<u></u>				Х	X	X		X	┖			_	_		Ш		\dashv	\dashv
1010-SWMST089-F	MST089	Ballard	Water	Filtered	Primary	<u> </u>	Х	Х	X	Х					Ш	X	Х	Х		X	Х	X			X
1010-SWMST089-U	MST089	Ballard	Water	Unfiltered	Primary	Х			$oxed{oxed}$				乚		Ш	X	X	X	Х	X	Х	X	Х	Х	Х
1010-SWMST089-F-MS	MST089	Ballard	Water	Filtered	MS	<u> </u>	X	Х	Х	Х			<u> </u>	L								Ш	\perp		_
1010-SWMST089-U-MS	MST089	Ballard	Water	Unfiltered	MS	Х																			
1010-SWMST089-F-MSD	MST089	Bailard	Water	Filtered	MSD		X	X	Х	Х						<u></u>								\perp	
1010-SWMST089-U-MSD	MST089	Ballard	Water	Unfiltered	MSD	Х																		ot	
1010-MST089-SD-001	MST089	Ballard	Sediment	NA	Primary						Х	Х	X	X	X									X	
1010-MST089-SD-002	MST089	Ballard	Sediment	NA	Primary						Х	X	X	Х	X									Χ	
1010-MST089-RS-001	MST089	Ballard	Soil	NA	Primary						Х	Х	Х		X									X	
1010-MST089-RS-002	MST089	Ballard	Soil	NA	Primary						X	Х	Х		X									ΧŢ	
1010-SWMST092-F	MST092	Bailard	Water	Filtered	Primary		X	Х	X	Х						X		Х	Х	X	Х	X	X	ΧŢ	Х
1010-SWMST092-U	MST092	Ballard	Water	Unfiltered	Primary	Х										X	Х	X	Х	X	Х	[X]	X	ХŢ	X
1010-MST092-SD-001	MST092	Ballard	Sediment	NA	Primary						X	Х	X	X			П					П		ХŢ	П
1010-MST092-RS-001	MST092	Ballard	Soil	NA	Primary						Х	Х	Х		Х					\Box				X	
1010-MST092-RS-001-MS	MST092	Ballard	Soil	NA	MS						Х	Х	Х		Х								┚		
1010-MST092-RS-001-MSD	MST092	Ballard	Soil	NA	MSD						Х	Х	Х		Х									J	
1010-MST092-RS-002	MST092	Ballard	Soil	NA	Primary						Х	Х	Х		Х					J			T	X	П
1010-SWMST093A-F-1	MST093A	Ballard	Water	Filtered	Primary		X	Х	X	Х						X	X	X	X	X	Х	X	X	X	X
1010-SWMST093A-U-1	MST093A	Ballard	Water	Unfiltered	Primary	Х										X	Х	Х	X	X	Х	X	X	X	X
1010-SWMST093A-F-2	MST093A	Ballard	Water	Filtered	Duplicate		X	Х	X	X			T		П	X	X	X	X	X	Х	X	\overline{x}	$\overline{\mathbf{x}}$	X

SAMPLES TO BE COLLECTED SOIL, SEDIMENT, AND SURFACE WATER (Page 2 of 6)

							Analyti	ical Lai	ora	tory Pa	aramet	er (Me	etho	d)					Fie	ld P	aramo	eter			
Field Sample Identification	Location	Mine	Matrix	Filtered/ Unflitered	QC Sample Type	Total Selenium (EPA 6020A)	Dissolved As, Cd, Cr, Co, Cu, NI, Ag. Ti, U, V (EPA 6020A)	Dissolved Sb, B, Ca, Mg, Mn, Mo, Zn (EPA 6010B)	Dissolved Mercury (7470A)	Dissolved Hardness (SM2340B-Calc)	Total As, Cd, Cr, Co, Cu, NI, Se, Ag, Ti, U, V (EPA 6020A)	Total Sb, B, Mn, Mo, Zn (EPA 6010B)	Mercu	AVS/SEM	TOC (Walkley-Black)	Conductivity (uS/cm)	Specific Conductivity (uS/cm)	Hd	Dissolved Oxygen (% sat)	Dissolved Oxygen (mg/L)	Oxidation/Reduction Potential (mV)	Turbidity (ftu)	Water Temperature (°C)	Air Temperature (°C)	Discharge (ft²/sec)
			1											_		T.,						1			_
1010-SWMST093A-U-2	MST093A	Ballard	Water	Unfiltered	Duplicate	×					L	V	┯	Ļ	IJ	×	X	X	×	<u> </u>	X	×	X	X	X
1010-MST093A-SD-001-1	MST093A	Ballard	Sediment	NA NA	Primary	<u> </u>	L		H		X	X	X	X	X	╀	Н	-	\vdash			┿	_	_	—
1010-MST093A-SD-001-2	MST093A	Ballard	Sediment	NA NA	Duplicate	-			H		X.	X	X	Х	X	╀	Н	-	\dashv	\dashv		╀	H	X	—
1010-MST093A-RS-001-1	MST093A	Ballard	Soil	NA	Primary				Н		X	X	X	_	X	⊢	Н	-	\dashv	\dashv		-	Н	X	<u> — </u>
1010-MST093A-RS-001-2	MST093A	Ballard	Soil	NA	Duplicate				Ш		X	X	X	<u> </u>	X	-		_	\dashv	_		╄	<u> </u>	X	—
1010-MST093A-RS-002-1	MST093A	Ballard	Soil	NA	Primary				Ш		X	X	X.	L.	X	┺		_	$oldsymbol{\sqcup}$	_		<u> </u>		Х	<u>—</u>
1010-MST093A-RS-002-2	MST093A	Ballard	Soil	NA	Duplicate						X	X	Х	_	X	Ļ.,		_		_		1.		Х	<u> </u>
1010-SWMST093B-F	MST093B	Ballard	Water	Filtered	Primary	Ь—	X	×	X	X			↓_	L	Ш	X		Х		X	X	X	Х	Х	X
1010-SWMST093B-U	MST093B	Ballard	Water	Unfiltered	Primary	X			oxdot			<u> </u>	ļ.,	Ļ		X	Х	Х	×	<u> </u>	Х	Х	Х	Х	X
1010-MST093B-SD-001	MST093B	Ballard	Sediment	NA	Primary	ļ					X	X	X	X	X	_				_		ـــــ	Щ	Х	<u>—</u>
1010-MST093B-RS-001	MST093B	Ballard	Soil	NA _	Primary	Ļ					X	X	X	<u> </u>	X	1_	Ш		\vdash	_		ـــــ	Щ	Х	<u>—</u>
1010-MST093B-RS-002	MST093B	Ballard	Soil	NA NA	Primary	L			lacksquare		X	X	X	_	X	_	Ш	_	Ш	_		<u> </u>	Ш	X	 -
1010-SWMST095-F	MST095	Ballard	Water	Filtered	Primary		X	X	X	X		L	ـــــ	Ц.	Ш	X	_	X	-	X	X	X	Х	Х	Х
1010-SWMST095-U	MST095	Ballard	Water	Unfiltered	Primary	X							_	$ldsymbol{ld}}}}}}$	Ш	X	X	X	X	×	X	X	X	Х	Х
1010-MST095-SD-001	MST095	Ballard	Sediment	NA	Primary				Ш		X	X	X	X	X	<u> </u>	Щ	_		4		Ь.	Ш	X	
1010-MST095-RS-001	MST095	Ballard	Soil	NA	Primary				Щ		Х	X	X	L	X	╙	Ш	_	Ц	_		L		X	
1010-MST095-RS-002	MST095	Ballard	Soil	NA	Primary						X	X	X	L	Х	┖	Щ	_				乚	Ш	X	
1010-SWMST272-F	MST272	Ballard	Water	Filtered	Primary		Х	Х	X	Х					Ш	X		Х		Х	Х	Х	X	Х	Х
1010-SWMST272-U	MST272	Ballard	Water	Unfiltered	Primary	X							\perp		Ш	X	Х	Х	Х	Х	Х	Х	Х	Х	X
1010-MST272-SD-001	MST272	Ballard	Sediment	NA	Primary						X	Х	X	Х	X		Ш			_			Ш	Х	
1010-MST272-SD-001-MS	MST272	Ballard	Sediment	NA	MS						X	Х	X	Х	Х				$oldsymbol{ol}}}}}}}}}}}}}}}}}}}}}$						
1010-MST272-SD-001-MSD	MST272	Ballard	Sediment	NA	MSD						X	X	Х	X	X										
1010-MST272-RS-001	MST272	Ballard	Soil	NA	Primary						Х	Х	X		Х		\Box		\Box					Х	
1010-MST272-RS-002	MST272	Ballard	Soil	NA	Primary						Х	Х	X		X									Х	
1010-SWMST273-F	MST273	Ballard	Water	Filtered	Primary		Х	Х	Х	Х						Х			Х	Х	Х	Х	Х	Х	Х
1010-SWMST273-U	MST273	Ballard	Water	Unfiltered	Primary	Х										Х	X	X	Х	X	X	X	Х	X	X
1010-MST273-SD-001	MST273	Ballard	Sediment	NA	Primary						Х	Х	Х	Х	Х									Х	
1010-MST273-RS-001	MST273	Ballard	Soil	NA	Primary						Х	Х	Х		Х									Х	
1010-MST273-RS-002	MST273	Ballard	Soil	NA	Primary						Х	Х	Х		Х									X	
1010-SWMSP017-F	MSP017	Enoch	Water	Filtered	Primary		Х	Х	Х	Х						Х	Х	X	Х	Х	Х	Х	X	Х	
1010-SWMSP017-U	MSP017	Enoch	Water	Unfiltered	Primary	X										Х	Х	Х	Х	Х	Х	Х	Х	Х	
1010-MSP017-SD-001	MSP017	Enoch	Sediment	NA	Primary						Х	Х	Х	Х	Х	Х	Х	X	Х	Х	Х	Х	Х	Х	
1010-MSP017-SD-002	MSP017	Enoch	Sediment	NA	Primary						Х	Х	Х	х	Х	X	Х	X	Х	X	X	Х	X	Х	
1010-MSP017-SD-003	MSP017	Enoch	Sediment	NA	Primary						Х	Х	X	х	X	X	X	ХÌ	X	x	X	X	X	х	

SAMPLES TO BE COLLECTED SOIL, SEDIMENT, AND SURFACE WATER (Page 3 of 6)

							Analyti	cal Lab	orat	orv Pa	ramet	er (Me	thoc	<u>i)</u>					Field	d Pa	rame	ter			—
							Ag,	Ę.		<u> </u>	-	<u> </u>		•	_										_
)20A)	Co, Cu, NI,	Mg, Mn, Mo,	70A)	(SM2340B-Calc)	Cu, NI, Se, Ag, TI	(EPA 601					uS/cm)		at)	5	Potential (mV)		-		
				Filtered/	QC Sample	fotal Selenium (EPA 6020A)	Dissolved As, Cd, Cr, C Ti, U, V (EPA 6020A)	Dissolved Sb, B, Ca, M (EPA 6010B)	Dissolved Mercury (7470A)	Dissolved Hardness (S	Total As, Cd, Cr, Co, Cl U, V (EPA 6020A)	otal Sb, B, Mn, Mo, Zn (EPA 6010B)	Total Mercury (7471A)	AVS/SEM	roc (Walkley-Black)	Conductivity (uS/cm)	Specific Conductivity (uS/cm)	T	Dissolved Oxygen (% sat)	Dissolved Oxygen (mg/L)	Oxidation/Reduction P	Turbidity (ftu)	Water Temperature (°C)	Air Temperature (°C)	Discharge (ft²/sec)
Field Sample Identification	Location	Mine	Matrix	Unfiltered	Туре	ř	<u> </u>	<u> </u>	۵		ř	Ĕ		₹	<u> </u>	<u>.</u>	S	풀	_	_		F	<u> </u>	⋖_	<u> </u>
1010-MSP017-SD-004	MSP017	Enoch	Sediment	NA	Primary						Х	Х	X	Х	X	Х	Х	_		ΧŢ	Х		ΧŢ		
1010-SWMSP018-F	MSP018	Enoch	Water	Filtered	Primary		X	Х	X	Х						Х	X			X	Х			X	
1010-SWMSP018-U	MSP018	Enoch	Water	Unfiltered	Primary	X										Х	Х	Х		Χ	Х	_		х	
1010-MSP018-SD-001	MSP018	Enoch	Sediment	NA	Primary						Х	Х	Х	Х	X	X.	X	X		x [Х			<u> </u>	_
1010-MSP018-SD-002	MSP018	Enoch	Sediment	NA	Primary				Ш		X	Х	X	Х	X	Х	X	Х		X	Х	_		X	_
1010-MSP018-SD-003	MSP018	Enoch	Sediment	NA	Primary						Х	Х	Х	Х	Х	X	Х	_	_	× l	Х			X	
1010-SWMSP020-F	MSP020	Enoch	Water	Filtered	Primary		X	Х	Х	X						Х	X	_	_	X	Х		_	X	
1010-SWMSP020-U	MSP020	Enoch	Water	Unfiltered	Primary	X							Ш	\Box		X	X	_		X	X			X	
1010-MSP020-SD-001	MSP020	Enoch	Sediment	NA	Primary				Ш		Х	Х	Χ.	X	X	X	X	_	_	<u>×</u>	Х		_	×	_
1010-MSP020-SD-002	MSP020	Enoch	Sediment	NA	Primary				Ш		X	X	LX	X	Х	X	X		_	X	X	_	_	X	
1010-MSP020-SD-003	MSP020	Enoch	Sediment	NA	Primary	L					Х	Х	X	X	X	Х	X	_		X	Х	_		X	
1010-MSP020-SD-004	MSP020	Enoch	Sediment	NA	Primary						X	Х	X	X	X	Х	Х	\rightarrow	_	×	Х	_	×	_	_
1010-MSP020-SD-005	MSP020	Enoch	Sediment	NA	Primary				Щ		X	×	X	X	Х	Х	X	Х		X	Х			X	_
1010-MSP020-SD-005-MS	MSP020	Enoch	Sediment	NA	MS	<u> </u>	<u></u>				X	X	X	×	Х	Х	X		_	×	Х	_		X	_
1010-MSP020-SD-005-MSD	MSP020	Enoch	Sediment	NA	MSD						Х	Х	X	X	X	Х	X	X		X	Х			X	_
1010-SWMSP021-F	MSP021	Enoch	Water	Filtered	Primary		X	X	X	Х			Ш	\Box	\perp	Х	X	\rightarrow	\rightarrow	×	Х	_	_	х	_
1010-SWMSP021-U	MSP021	Enoch	Water	Unfiltered	Primary	X							Ш		_	Х	Х		_	X	X			X	_
1010-MSP021-SD-001	MSP021	Enoch	Sediment	NA	Primary				Щ		Х	X	X	Х	X	Х	Х	\rightarrow	\rightarrow	X	X			X	_
1010-MSP021-SD-002-1	MSP021	Enoch	Sediment	NA	Primary				Ш		X	X	X	X	X	Х	Х	X	_	X	Х			×	-4
1010-MSP021-SD-002-2	MSP021	Enoch	Sediment	NA	Duplicate				Щ		X	X	Х	X	X	Х	X	X		×	X	_	_	×	-
1010-MSP021-SD-003	MSP021	Enoch	Sediment	NA	Primary				Ш		X	X	X	X	X	X	X		_	× l	X		_	×	4
1010-MSP021-SD-004	MSP021	Enoch	Sediment	NA .	Primary	<u> </u>			Щ		Х	_X_	X	X	<u> </u>	X	X	X	_	<u>×</u> ا	X	_	_	×	\dashv
1010-SWMSP023-F	MSP023	Enoch	Water	Filtered	Primary	L.,_	Х	Х	X	X			⊢	\Box	-	X	X	×1	_	<u>×۱</u>	X	_	_	×	\dashv
1010-SWMSP023-U	MSP023	Enoch	Water	Unfiltered	Primary	X			Н				ļ.,			X	X	×۱	_	<u>×</u> ا	X	_	_	X	\dashv
1010-MSP023-SD-001	MSP023	Enoch	Sediment	NA	Primary				Щ		X	X	X	X	X	X	X	×۱		<u>X</u>	X			X	_
1010-MSP023-SD-002	MSP023	Enoch	Sediment	NA	Primary				Н		Х	X	X	X	X	X	X	X	_	X	X		_	X	-
1010-MSP023-SD-003	MSP023	Enoch	Sediment	NA NA	Primary				Н		X	X	X	X	ХÌ	X	X	共		ХÌ	X			X	
1010-MSP023-SD-004	MSP023	Enoch	Sediment	NA	Primary	<u> </u>	Ų.		IJ	.	Х	Х	X	Х	<u> </u>	X	X	X	_	Χ	X	_	_	X	\dashv
1010-SWMSP031-F-1	MSP031	Enoch	Water	Filtered	Primary	L_	X	<u> </u>	×	X	ļ		Н	\sqcup	\dashv	X	Ŷ	X		ХÌ	X			쉬	\dashv
1010-SWMSP031-U-1	MSP031	Enoch	Water	Unfiltered	Primary	X	.		W				\vdash	\vdash	\dashv	X	X	X	_	X	. X	-	_	X	\dashv
1010-SWMSP031-F-2	MSP031	Enoch	Water	Filtered	Duplicate	L	X	X	X	<u></u>	<u> </u>		\vdash	Н	-	X	X	X	_	X	X		_	X	\dashv
1010-SWMSP031-U-2	MSP031	Enoch	Water	Unfiltered	Duplicate	X	l v	· ·	IJ				\vdash	\sqcup	-	×	Х	×	×	<u>×</u>	Х	X	×	X	-1
1010-SWMSP031-F-1-MS	MSP031	Enoch	Water	Filtered	MS	L	X	_ <u>_x</u> _	X	X			\vdash	Н	\dashv	\vdash			\dashv	+		\mapsto	\dashv	\dashv	\dashv
1010-SWMSP031-U-1-MS	MSP031	Enoch	Water	Unfiltered	MS	X					:	L		Ш		Ш						لــــــــــــــــــــــــــــــــــــــ		ᆚ	

SAMPLES TO BE COLLECTED SOIL, SEDIMENT, AND SURFACE WATER (Page 4 of 6)

					-		Analyt	ical La	bora	tory Pa	aramet	er (Me	thoc	1)			_	_	Fie	ld P	arame	eter			_
Field Sample Identification	Location	Mine	Matrix	Filtered/ Unflitered	QC Sample Type	Total Selenium (EPA 6020A)	Dissolved As, Cd, Cr, Co, Cu, Ni, Ag, Ti, U, V (EPA 6020A)	Dissolved Sb, B, Ca, Mg, Mn, Mo, Zn (EPA 6010B)	Dissolved Mercury (7470A)	Dissolved Hardness (SM2340B-Calc)	Total As, Cd, Cr, Co, Cu, Ni, Se, Ag, Ti, U, V (EPA 6020A)	Total Sb, B, Mn, Mo, Zn (EPA 6010B)	Total Mercury (7471A)	AVS/SEM	TOC (Walkiey-Black)	Conductivity (uS/cm)	Specific Conductivity (uS/cm)	ЬН	Dissolved Oxygen (% sat)	Dissolved Oxygen (mg/L)	Oxidation/Reduction Potential (mV)	Turbidity (ftu)	Water Temperature (°C)	Air Temperature (°C)	Discharge (ft²/sec)
1010-SWMSP031-F-1-MSD	MSP031	Enoch	Water	Filtered	MSD	Γ	Ιx	х	X	х	Ι	-	$\overline{}$									Ι.	П	\neg	
1010-SWMSP031-U-1-MSD	MSP031	Enoch	Water	Unfiltered	MSD	X							П	\dashv	_	Н	\vdash					1	Н	\dashv	—
1010-MSP031-SD-001-1	MSP031	Enoch	Sediment	NA	Primary			 	t^{-}	-	Х	Х	x	\mathbf{x}	\mathbf{x}^{\dagger}	х	X	\overline{x}	X	x	×	x	x	\overline{x}	—
1010-MSP031-SD-001-2	MSP031	Enoch	Sediment	NA NA	Duplicate	1			Н		X	X	X	$\frac{\hat{x}}{x}$	$\frac{\hat{x}}{x}$	x	$\hat{\mathbf{x}}$	X	x	x	$\frac{\hat{x}}{x}$	 \hat{x}	x	â	—
1010-MSP031-SD-002	MSP031	Enoch	Sediment	NA	Primary	<u> </u>			\vdash		X	X	X	$\frac{x}{x}$	$\frac{\alpha}{x}$	X	X	X	X	X	X	X	x	$\frac{\hat{x}}{x}$	_
1010-MSP031-SD-003	MSP031	Enoch	Sediment	NA	Primary		 	\vdash	\vdash		X	X	l X l	$\frac{\hat{x}}{x}$	$\frac{\hat{x}}{x}$	X	X	X	X	$\hat{\mathbf{x}}$	$\frac{\alpha}{x}$	x	X	Ĥ	_
1010-SWMST131-F	MST131	Enoch	Water	Filtered	Primary		X	X	X	X		<u> </u>	 	$\stackrel{\sim}{+}$	$\stackrel{\sim}{+}$	X	X	X	X	$\frac{1}{x}$	X	 \hat{x}	X	$\frac{\hat{\mathbf{x}}}{\mathbf{x}}$	х
1010-SWMST131-U	MST131	Enoch	Water	Unfiltered	Primary	X	 	 ^`	 ``	<u> </u>			1 1	\dashv	\dashv	X	$\frac{\hat{\mathbf{x}}}{\mathbf{x}}$	x	X	ŵl	$\frac{\hat{x}}{x}$	 \hat{x}	X	χĺ	x
1010-MST131-SD-001	MST131	Enoch	Sediment	NA	Primary		-		\vdash		X	X	x	\times	x	Ĥ	$\stackrel{\sim}{+}$	$\stackrel{\sim}{\dashv}$	$\stackrel{\sim}{\vdash}$	$\stackrel{\sim}{+}$		 ^ -	 ^ 	x l	<u> </u>
1010-MST131-SD-002	MST131	Enoch	Sediment	NA.	Primary		-		\vdash		$\frac{\hat{x}}{x}$	$\frac{\hat{x}}{x}$	X		$\frac{\hat{x}}{x}$	\vdash	\dashv	-	\vdash	\dashv		\vdash	\vdash	Ĥ	—
1010-MST131-RS-001	MST131	Enoch	Soil	NA NA	Primary		├──		\vdash		X	X	X	$\stackrel{\sim}{+}$	â				\dashv	\dashv		╁	\vdash	x t	
1010-MST131-RS-002	MST131	Enoch	Soil	NA.	Primary						X	X	X	-	x l		+		-	-+		\vdash	\vdash	Ĥ	
1010-SWMST274A-F	MST274A	Enoch	Water	Filtered	Primary		X	X	х	×			 ^ 		$\stackrel{\sim}{+}$	х	х	x	x	x	Х	x	x	_	Х
1010-SWMST274A-U	MST274A	Enoch	Water	Unfiltered	Primary	X	<u> </u>	<u> </u>	Ĥ				 	\dashv	+	$\frac{\hat{\mathbf{x}}}{\mathbf{x}}$		$\hat{\mathbf{x}}$	$\hat{\mathbf{x}}$	xl	$\frac{\hat{x}}{x}$	Î			$\hat{\mathbf{x}}$
1010-MST274A-SD-001	MST274A	Enoch	Sediment	NA	Primary	<u> </u>			1		х	Х	x	x	xt	Ĥ	$\stackrel{\sim}{H}$		$\hat{}$	$\stackrel{\sim}{+}$		اث	$\stackrel{\sim}{+}$	ŝl	<u>~</u>
1010-MST274A-RS-001	MST274A	Enoch	Soil	NA.	Primary				\vdash		X	X	X	Ĥ	x ₩	-		ᅱ		+		\vdash	\vdash	ŵl	—
1010-MST274A-RS-002	MST274A	Enoch	Soil	NA.	Primary				1	-	X	X	X	┪	$\frac{\hat{x}}{x}$	╌┪		\dashv	\dashv	-		H	\vdash	ŵ ۱	-
1010-SWMST274B-F	MST274B	Enoch	Water	Filtered	Primary		X	X	x	х	$\hat{}$		lĤ	+	^+	x	$\frac{1}{x}$	\overline{x}	x	${x}$	Х	x	x	-	х
1010-SWMST274B-U	MST274B	Enoch	Water	Unfiltered	Primary	×		<u> </u>	Ĥ				1	+	-#	x	_	Ŷ	$\hat{\mathbf{x}}$	âl	$\hat{\mathbf{x}}$	x			Ŷ
1010-MST274B-SD-001	MST274B	Enoch	Sediment	NA	Primary				Н		х	X	x	\mathbf{x}	x	Ĥ	$\stackrel{\sim}{+}$		Ĥ	^ +		 ^-	_	Ĥ	<u> </u>
1010-MST274B-RS-001	MST274B	Enoch	Soil	NA NA	Primary				\vdash		$\frac{\hat{x}}{\hat{x}}$	X	X	$\stackrel{\sim}{+}$	Ĥ	\dashv	\dashv		-			Н	$\overline{}$	Ĥ	—
1010-MST274B-RS-002	MST274B	Enoch	Soil	NA NA	Primary				H		$\frac{\hat{x}}{x}$	X	X	┪	Ĥ	-	-	\dashv	\dashv	\dashv		\vdash	_	ŵl	
·	MST275A	Enoch	Water	Filtered	Primary		Х	Х	x	Х			 ^ 	┪	\hat{H}	x	${x}$	\overline{x}	$\frac{1}{x}$	$\frac{1}{x}$	×	х			\mathbf{x}
1010-SWMST275A-U	MST275A	Enoch	Water	Unfiltered	Primary	Х	 -	 ^_	+	_^_			\vdash	-+	-H	\$		Ĥ		Ĥ	$\hat{\mathbf{x}}$	x			쉯
	MST275A	Enoch	Sediment	NA	Primary				Н		х	х	X	$\frac{1}{x}$	$\times \parallel$		^	^	Ĥ	Ĥ		H		Ĥ	<u> </u>
1010-MST275A-RS-001	MST275A	Enoch	Soil	NA I	Primary				Н		$\hat{\mathbf{x}}$	$\hat{\mathbf{x}}$	 		Ĥ	\dashv	\dashv	\dashv	\dashv	\dashv			_	श ी	\dashv
1010-MST275A-RS-002	MST275A	Enoch	Soil	NA NA	Primary				\vdash		x	$\hat{\mathbf{x}}$	 		₹H	\vdash			\dashv	\dashv		Н		श ि	
1010-SWMST275B-F	MST275B	Enoch	Water	Filtered	Primary		Х	Х	x	Х			\Box	\dashv	^	\mathbf{x}	$\frac{1}{x}$	x	$\frac{1}{x}$	$\frac{1}{x}$	×	×		_	\overline{x}
1010-SWMST275B-U	MST275B	Enoch	Water	Unfiltered	Primary	х			$\frac{ }{ }$				$\vdash \vdash$	-+	╼╫	_	_	_	_	xl	ŵ	x			Ĥ
1010-MST275B-SD-001	MST275B	Enoch	Sediment	NA	Primary				Н		х	X	x	$\frac{1}{x}$	ӿ╢	^	弁	<u> </u>	~	$\stackrel{\sim}{+}$	^	H		Ĥ	긔
1010-MST275B-RS-001	MST275B	Enoch	Soil	NA NA	Primary				H		$\hat{\mathbf{x}}$	$\frac{\hat{x}}{x}$	X		ĤX		\dashv	\dashv	\dashv	\dashv		Н		ŝt	\dashv
1010-MST275B-RS-002	MST275B	Enoch	Soil	NA NA	Primary				\vdash		$\hat{\mathbf{x}}$	$\hat{\mathbf{x}}$	X	_	Ĥ	\dashv	\dashv	\dashv	\dashv	-		H		ŝl	
1010-SWMSP014-F	MSP014	Henry	Water	Filtered	Primary		X	X	x	×	^	^	 ^ 	\dashv	—н	×	$\frac{1}{x}$	$\frac{1}{x}$	$\frac{1}{x}$	\forall	×	x	_	Ĥ	\dashv
1010-SWMSP014-P	MSP014	Henry	Water	Unfiltered	Primary	Y			H				\vdash	\dashv	╫	Ĥ		Ĥ	ŝl	\$ †	÷	x	_	श	\dashv

SAMPLES TO BE COLLECTED SOIL, SEDIMENT, AND SURFACE WATER (Page 5 of 6)

							Analyti	cal Lab	orat	ory Pa	aramete	er (Me	tho)					Fiel	d Pa	rame	ter			
Field Sample Identification	Location	Mine _	Matrix	Filtered/ Unflitered	QC Sample Type	Total Selenium (EPA 6020A)	Dissolved As, Cd, Cr, Co, Cu, Ni, Ag, Ti, U, V (EPA 6020A)	Dissolved Sb, B, Ca, Mg, Mn, Mo, Zn (EPA 6010B)	Dissolved Mercury (7470A)	Dissolved Hardness (SM2340B-Calc)	Total As, Cd, Cr, Co, Cu, Ni, Se, Ag, Ti, U, V (EPA 6020A)	Total Sb, B, Mn, Mo, Zn (EPA 6010B)		AVS/SEM	TOC (Walkley-Black)	Conductivity (uS/cm)	Specific Conductivity (uS/cm)	На	Dissolved Oxygen (% sat)	Dissolved Oxygen (mg/L)	Oxidation/Reduction Potential (mV)	Turbidity (ftu)	Water Temperature (°C)	Air Temperature (°C)	Discharge (ft²/sec)
	1,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		10-4:	NA NA	Primary						Х	х	X	X	ХĪ	X	x	хI	хI	хT	×	X	ХI	х	\neg
1010-MSP014-SD-001-1	MSP014	Henry	Sediment	NA NA					Н		 	x	tŝ	Ŷ	â	x	Ŷ	Ĥ		ŵ ۱	$\hat{\mathbf{x}}$	x		ŵ	\dashv
1010-MSP014-SD-001-2	MSP014	Henry	Sediment	NA NA	Duplicate Primary		<u> </u>		\vdash		x	- - -	 	Ŷ	â	Î	Ŷ			Ĥ	ŵ	X	_	Ĥ	\dashv
1010-MSP014-SD-002	MSP014	Henry	Sediment	NA NA	Primary	<u> </u>	-		Н		\	÷	lŝ	Ŷ	÷	x	Ŷ	\rightarrow	_	솼	÷	x		ŵ	ᅱ
1010-MSP014-SD-003	MSP014	Henry	Sediment	NA NA	Primary	<u> </u>			Н		Î	÷	Î	x	â	x	Ŷ		_	ŝl	ŵ	x		Ĥ	-
1010-MSP014-SD-004	MSP014	Henry	Sediment	NA NA	Primary	-			\vdash		Î	÷	Î	x	â	x	x	\rightarrow	\rightarrow	Ĥ	$\hat{\mathbf{x}}$	x		â	
1010-MSP014-SD-005	MSP014	Henry	Sediment Water	Filtered	Primary	-	X	x	X	X	<u> </u>		 ^	Ĥ	^ +	x	Ŷ	â		Ĥ	$\frac{\hat{x}}{x}$	X	ŵl	â	\dashv
1010-SWMSP015-F 1010-SWMSP015-U	MSP015	Henry	Water	Unfiltered	Primary	X	 ^-		H		ļ		╁	H	\dashv	Î	ŵ	ŵl	$\overline{}$	ŵl	$\hat{\mathbf{x}}$	x	_	â	\dashv
	MSP015 MSP015	Henry	<u> </u>	NA	Primary	 ^			Н		X	×	tx	×	X.	x	Ŷ	ŵ l		ŝ t	$\hat{\mathbf{x}}$	x	_	â	\dashv
1010-MSP015-SD-001		Henry	Sediment Sediment	NA NA	Primary	-			Н		 x 	x	l ŝ	x	$\frac{\hat{\mathbf{x}}}{\mathbf{x}}$	x	x	Ĥ		ŝt	$\hat{\mathbf{x}}$	x	_	â	\dashv
1010-MSP015-SD-002 1010-MSP015-SD-003	MSP015	Henry	Sediment	NA NA	Primary				Н		l x	Ŷ	lŝ	Î	â	Î	Ŷ	Ĥ	_	ŝ t	â	x	_	x	\dashv
	MSP015	Henry		NA NA	Primary	-			Н		 x 	x	l ŝ	x	â	x	x			ŝ t	$\hat{\mathbf{x}}$	x	\rightarrow	â	\dashv
1010-MSP015-SD-004 1010-SWMSP016-F	MSP015	Henry	Sediment Water	Filtered	Primary	-	X	×	x	х	 ^ 	<u> </u>	₩	Ĥ	Ĥ	Î	x	≆ l	_	x t	$\hat{\mathbf{x}}$	X	_	$\hat{\mathbf{x}}$	\dashv
1010-SWMSP016-P	MSP016	Henry	Water	Unfiltered	Primary	X	 ^	<u> </u>	Ĥ				+	\vdash	\dashv	Î	x			Ĥ	$\frac{\hat{x}}{x}$	X	_	X	\dashv
1010-SWMSP016-U	MSP016	Henry	Sediment	NA	Primary	 ^			Н		×	×	×	x	x	x	x	Ĥ	_	Ĥ	$\frac{\hat{x}}{x}$	X	_	â	\dashv
1010-MSP016-SD-001	MSP016	Henry	Sediment	NA NA	Primary		-		Н		 x 	x	lŝ	x	â	x	ŵ		_	â	$\hat{\mathbf{x}}$	x	$\overline{}$	$\hat{\mathbf{x}}$	
1010-MSP016-SD-002	MSP016 MSP016	Henry	Sediment	NA NA	Primary	├-			H		Î	x	Î	Î	x	x	x	_	_	x t	$\frac{\hat{x}}{x}$	x	_	x	-
1010-MSP016-SD-003-MS	MSP016	Henry	Sediment	NA NA	MS	-			Н		x	x	l â	x	x	Ĥ	$\hat{}$	$\stackrel{\sim}{+}$	Ĥ	^		H	$\stackrel{\sim}{H}$	^	\dashv
1010-MSP016-SD-003-MSD	MSP016	Henry	Sediment	NA NA	MSD		_		Н		 x 	x	l x	x	x	Н	\dashv	┪	-	\dashv		Н	-	\dashv	\dashv
1010-MSP016-SD-003-MSD	MSP016	Henry	Sediment	NA NA	Primary				Н		 x	×	l â	Î	$\hat{\mathbf{x}}$	x	x	$\frac{1}{x}$	\overline{x}	\overline{x}	X	x	$\frac{1}{x}$	х	\dashv
1010-MSP016-SD-004-1	MSP016	Henry	Sediment	NA NA	Duplicate	-		_			 x	X	 x	x	$\frac{\hat{x}}{x}$	x	$\hat{\mathbf{x}}$	_	_	x t	$\frac{\hat{x}}{x}$	X		X	ᅥ
1010-WSF010-SD-004-2	MST053	Henry	Water	Filtered	Primary		×	×	x	Х	 ^ 	<u> </u>	 ^ -	Ĥ	$\stackrel{\sim}{+}$	x	$\hat{\mathbf{x}}$	_	_	x t	$\frac{\hat{x}}{x}$	X	\rightarrow	x	ᆏ
1010-SWMST053-U	MST053	Henry	Water	Unfiltered	Primary	X	<u> </u>		Н		1		\vdash	\vdash	\dashv				_	$\frac{\alpha}{x}$	X	X		X	$\hat{\mathbf{x}}$
1010-SVVMS1053-0	MST053	Henry	Sediment	NA	Primary	 ^			H		 x 	X	 x	×	×	Н				~		H	\dashv	X	\dashv
1010-MST053-SD-001	MST053	Henry	Sediment	NA NA	Primary	-			Н		 x	X	 x	X	$\frac{\hat{x}}{x}$	Н		┪	-	-+		Н	\dashv	X	ᅥ
1010-MST053-RS-001	MST053	Henry	Soil	NA NA	Primary	 			\vdash		X	X	X	H	X	Н	Н	\dashv	\dashv	\dashv		Н	\dashv	X	\dashv
1010-MST053-RS-002	MST053	Henry	Soil	NA NA	Primary	<u> </u>			Н		X	X	X		X	Н		-		\dashv		Н	\dashv	X	一
1010-SWMST277A-F	MST277A	Henry	Water	Filtered	Primary	 	х	Х	X	X	+ -		Ħ		\dashv	x	x	\mathbf{x}^{\dagger}	\mathbf{x}	x	Х	x	x	$\frac{\hat{x}}{x}$	X
1010-SWMST277A-U	MST277A	Henry	Water	Unfiltered	Primary	X		<u> </u>	Н		 		T	\vdash		x	X			$\frac{a}{x}$	X	X		X	$\frac{\alpha}{x}$
1010-MST277A-SD-001	MST277A	Henry	Sediment	NA	Primary	<u> </u>			H		x	X	x	x	x	Н		+	-	-+		Н	\dashv	X	\dashv
1010-MST277A-SB-001	MST277A	Henry	Soil	NA NA	Primary				H		X	X	$\frac{1}{x}$	\vdash	$\frac{\hat{x}}{x}$	Н	-	-†	+	_		Н	\dashv	X	ㅓ
1010-MST277A-RS-002	MST277A	Henry	Soil	NA NA	Primary	-			Н		X	X	X	\vdash	X	\vdash	\neg	\dashv	寸	寸		Н	\dashv	X	\dashv
1010-SWMST277B-F	MST277B	Henry	Water	Filtered	Primary		х	х	x	Х			1	\vdash	$\neg \dagger$	X	х	x	\mathbf{x}	x	Х	X	\mathbf{x}	X	\overline{x}
1010-SWMST277B-U	MST277B	Henry	Water	Unfiltered	Primary	X			Н		\vdash		\vdash	\vdash	-	X	X			\overline{x}	X	X	X	X	X

SAMPLES TO BE COLLECTED SOIL, SEDIMENT, AND SURFACE WATER (Page 6 of 6)

							Analyt	cal Lal	orat	ory Pa	ramet	er (Me	tho	d)				Fi	eld Pa	rame	ter		
Field Sample Identification	Location	Mine	Matrix	Filtered/ Unfiltered	QC Sample Type	Total Selenium (EPA 6020A)	Dissolved As, Cd, Cr, Co, Cu, Ni, Ag. Ti, U, V (EPA 6020A)	Dissolved Sb, B, Ca, Mg, Mn, Mo, Zn (EPA 6010B)	Dissolved Mercury (7470A)	Dissolved Hardness (SM2340B-Calc)	Total As, Cd, Cr, Co, Cu, Ni, Se, Ag, Ti, U, V (EPA 6020A)	Total Sb, B, Mn, Mo, Zn (EPA 6010B)	Total Mercury (7471A)	AVS/SEM	TOC (Walkley-Black)	Conductivity (uS/cm)	Specific Conductivity (uS/cm)	pH Dissolved Oxygen (% sat)	Dissolved Oxygen (mg/L)	Oxidation/Reduction Potential (mV)	Turbidity (ftu)	ter Temperatu	Air Temperature (°C) Discharge (# ² /sec)
1010-MST277B-SD-001	MST277B	Henry	Sediment	NA	Primary				П		X	Х	Х	х	хI	I	Т	T	П		П	Т	хT
1010-MST277B-RS-001	MST277B	Henry	Soil	NA	Primary				П		Х	X	х	П	х				Ħ		T	寸	x
1010-MST277B-RS-002	MST277B	Henry	Soil	NA	Primary						Х	X	Х		x				Ħ			寸	x
1010-ER-SW-01-U	na	na	Water	Unfiltered	Equip Rinsate				Ħ		X	X	X		T				Ħ	_		\neg	
1010-ER-SD-01-U	na	na	Water	Unfiltered	Equip Rinsate				П		X	Х	X	П			\neg		\Box		T		
1010-ER-SD-02-U	na	na	Water	Unfiltered	Equip Rinsate				П		Х	Х	X		7				П			1	T
1010-ER-SD-03-U	na	na	Water	Unfiltered	Equip Rinsate				П		Х	Х	Х		\Box		\Box		П			\neg	\neg
1010-ER-SD-04-U	na	na	Water	Unfiltered	Equip Rinsate						Х	X	Х										\perp
1010-ER-SD-05-U	na	na	Water	Unfiltered	Equip Rinsate						Х	Х	Х						П				
1010-ER-RS-01-U	na	na	Water	Unfiltered	Equip Rinsate						Х	X	X						П			T	
1010-ER-RS-02-U	na	na	Water	Unfiltered	Equip Rinsate						Х	X	Х									T	\neg
1010-ER-RS-03-U	na	na	Water	Unfiltered	Equip Rinsate						Х	Х	Х										\top
1010-ER-RS-04-U	na	na	Water	Unfiltered	Equip Rinsate						Х	Х	Х									T	
1010-ER-RS-05-U	na	na	Water	Unfiltered	Equip Rinsate				ΙТ		Х	Х	X	П	П				П			T	\top

Blank example: 1010-B-SW-01

AVS/SEM - acid volatile sulfides/simultaneously extracted metals

B - source water blank sample, to be taken once per field effort

ER - equipment rinsate blank sample, to be taken once per field team per day, total ERs taken may not add up to what is accounted for here

MS - matrix spike

MSD - matrix spike duplicate

NA - not applicable

QC - quality control

TABLE 4-3

PROJECT PERFORMANCE MEASUREMENT CRITERIA (Page 1 of 1)

DQI	Criteria	Project-Specific Goal ^a
Detection levels	The analytical detection levels should be less than the applicable screening criteria.	The achievable laboratory reporting limits and method detection limits for soil/sediment and surface water samples are listed on Table 4-1. Laboratory reporting limits are less than or equal to all screening levels (see Tables 4-4 through 4-8), except the following: • Arsenic in soil for human health risk (HHR) (Table 4-4) • Antimony and arsenic in surface water for HHR (Table 4-5) • Antimony, boron, and selenium in soil for ecological risk (Table 4-6)
Accuracy	Spiked target analytes should be recovered within the limits established for each target analyte.	Recoveries of target analytes spiked into laboratory control samples, matrix spike samples, and low-level calibration samples should be within the control limits specified on Tables 4-9 through 4-12 for those quality control samples.
Precision	Measured values of target analytes should be reproducible within the limits established for each target analytes.	Relative percent differences (RPDs) measured between laboratory control samples and laboratory control sample duplicates & matrix spike and matrix spike duplicates should be within the control limits specified on Tables 4-4 through 4-8 for those quality control samples. The RPDs for field duplicate samples will be assessed as described in Section 4.4.
Completeness	Each sample that is planned to be collected should be collected, analyzed, reported, and validated for each target analyte as specified in Section 4.4, except where actual site conditions prevent collection of sample as planned (e.g., water not flowing in stream).	A minimum of 90% of planned soil and sediment samples and 80% of planned surface water samples will be collected. All target analytes will be tested, reported, and validated for each collected sample.

TABLE 4-4

Target Analyte List, MDLs, RLs, and Human Health Risk Screening Levels for Riparian Soil

			_	USEPA Regional for	_
Parameter	Analytical Method	MDL (mg/kg)	RL (mg/kg)	Residential (mg/kg)	Industrial (mg/kg)
Metals					
Antimony	EPA 6010B	3	10	31 ^a	410 ^a
Arsenic	EPA 6020A	0.06	0.5	0.39 b,x	1.6 ^b
Boron	EPA 6010B	0.4	10	16,000 ^c	200,000 ^c
Cadmium	EPA 6020A	0.004	0.02	70 ^d	800 ^d
Chromium ^e	EPA 6020A	0.03	0.2	120,000	1,500,000 ^f
Cobalt	EPA 6020A	0.003	0.02	23	300
Copper	EPA 6020A	0.08	0.1	3,100	41,000
Manganese	EPA 6010B	0.04	2	1,800 ^g	23,000 ^g
Mercury	EPA 7471A	0.002	0.02	4.3 ^h	24 ^h
Molybdenum	EPA 6010B	0.5	2	390	5,100
Nickel	EPA 6020A	0.03	0.2	1,500 ⁱ	20,000 ⁱ
Selenium	EPA 6020A	0.2	1	390	5,100
Silver	EPA 6020A	0.008	0.02	390	5,100
Thallium	EPA 6020A	0.003	0.02	5.1 ⁱ	66 ⁱ
Uranium	EPA 6020A	0.006	0.02	230 '	3100 ⁱ
Vanadium	EPA 6020A	0.02	0.2	390 ^j	5,200 ^j
Zinc	EPA 6010B	0.3	2	23,000 ^a	310,000 ^a
Other					
TOC	Walkley-Black	0.07%	0.2%	na	na

Notes:

COPC - chemical of potential concern

MDL - method detection limit

mg/kg - milligrams per kilogram

RL - reporting limit

TOC - total organic carbon

USEPA - United States Environmental Protection Agency

^a Screening value for metallic compound.

^b Screening value for inorganic form of arsenic.

^c Screening value for boron and borates only.

^d Screening value is based on toxicity information from dietary cadmium.

^e Measured as total chromium; however, because chromium VI was not detected in soil samples, total chromium is assumed to be represented by chromium III.

f Insoluble salts. Although the correct screening level is listed, 1,500,000 mg/kg is not possible because there are 1,000,000 milligrams in a kilogram.

⁹ Screening value is based on toxicity information for manganese in drinking water.

^h Screening value is for elemental mercury.

Screening value is for soluble salts.

¹ Screening value for vanadium and compounds.

^x Laboratory RL is greater than lowest screening value.

TABLE 4-5

Target Analyte List, MDLs, RLs, and Human Health Risk Screening Levels for Surface Water

Monitoring	Analytical	MDL	RL	State of Idaho Standards Surface	National Stand Lif Organism Con	e ³	USEPA Regional SL ⁴	-	arison Values ng Water ⁵	USEP	A MCL ⁶	Proposed COPC Screening
Monitoring Parameter ¹	Method	(mg/L)	(mg/L)	Water ² (mg/L)	W+O (mg/L)	O Only (mg/L)	Tap Water (mg/L)	Child (mg/L)	Adult (mg/L)	Primary (mg/L)	Secondary (mg/L)	Criteria ⁷ (mg/L)
Antimony	EPA 6010B	0.003	0.010	0.0056	0.0056	0.640	0.015	0.004	0.010	0.006		0.0056 ^x
Arsenic	EPA 6020A	0.0001	0.0005	0.050	0.000018	0.00014	0.000045	0.003	0.010	0.01		0.050
Boron	EPA 6010B	0.002	0.010				7.3	0.1	0.4	• •		7.3
Cadmium	EPA 6020A	0.00002	0.000005				0.018					0.018
Chromium	EPA 6020A	0.00004	0.0002				55/0.11 a	0.1	0.1	0.1		0.11
Cobalt	EPA 6020A	0.00002	0.000006				0.011	0.1	0.4			0.011
Copper	EPA 6020A	0.00002	0.0001				1.5	0.1	0.4	1.3	1.0	1.5
Manganese	EPA 7470A	0.0002	0.0006				0.88					0.88
Mercury	EPA 6020A	0.00002	0.0005				0.0037			0.002		0.0037
Molybdenum	EPA 6010B	0.0006	0.020				0.18	0.05	0.2		- -	0.18
Nickel	EPA 6020A	0.00003	0.001	0.61	0.61	4.6	0.73					0.61
Selenium	EPA 6020A	0.0003	0.001	0.17	0.17	4.2	0.18			-,-		0.17
Silver	EPA 6020A	0.000004	0.00002				0.18	0.05	0.2		0.1	0.18
Thallium	EPA 6020A	0.000005	0.00002	0.00024			0.0024			0.002		0.00024
Uranium	EPA 6020A	0.000003	0.00002		- -		0.26	0.03	0.03	- }-		0.26
Vanadium	EPA 6020A	0.00003	0.0002				0.11	0.03	0.03	0.03		0.11
Zinc	EPA 6010B	0.0007	0.020	7.4	7.4	26	11					7.4

Notes:

- ¹ Monitoring parameters included in 2009 Surface Water Monitoring Sampling and Analysis Plan (MWH, 2009). Concentrations for all parameters are dissolved unless otherwise noted.
- ² State of Idaho Surface Water Quality for Domestic Water Supply Use (IDAPA 58.01.02).
- ³ National Recommended Water Quality Criteria (USEPA, 2009); Criteria for Human Health for Organism Consumption of Water + Organism (W+O) and Organism Only (O Only).
- ⁴ USEPA Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm, April 2009).
- ⁵ Public Health Assessment: Southeast Idaho Phosphate Mining Resource Area: Bannock, Bear Lake, Bingham, and Caribou Counties, Idaho EPA Facility ID: IDN001002245 (U.S. Department of Health and Human Services, Public Health Services, Agency for Toxic Substances and Disease Registry, 2006).
- ⁶ USEPA primary and secondary Maximum Contaminant Level (MCL), National Primary Drinking Water Regulations (http://www.epa.gov/safewater/contaminants/index.html#rads, 17 March 2008).
- ⁷ Proposed COPEC screening criteria is based on the following hierarchy:
- 1) State of Idaho Surface Water Quality for Domestic Water Supply Use (IDAPA 58.01.02).
- 2) National Recommended Water Quality Criteria (USEPA, 2009); Criteria for Human Health for Organism Consumption of Water + Organism (W+O) and Organism Only (O Only).
- 3) USEPA RSLs for Chemical Contaminants at Superfund Sites (April 2009).
- 4) Public Health Assessment: Southeast Idaho Phosphate Mining Resource Area (USDHHS, PHS and ATSDR, 2006).
- 5) USEPA primary and secondary MCLs, National Primary Drinking Water Regulations (USEPA, 2008).
- ^a Values specified are for chromium III/VI. If data are screened against these standards, then the total chromium results will be compared to the chromium VI standard.
- b Reporting limit (RL) is greater than screening value, but the method detection limit (MDL) is less than the screening value.
- * Laboratory RL is greater than lowest screening value.

ATSDR - Agency for Toxic Substances and Disease Registry

COPC - chemicals of potential concern

IDAPA Idaho Administrative Procedures Act

MDL - method detection limit

mg/L - milligrams per liter

PHS - United States Public Health Service

RL - reporting limit

USDHHS - United States Department of Health and Human Services

USEPA - United States Environmental Protection Agency



Target Analyte List, MDLs, RLs, and Ecological Risk Screening Levels for Riparian Soil (Page 1 of 2)

				Lowest Soil		Eco-SSL	a (mg/kg)	1	ORNL Ecolo	ogical Bench	mark ^b (mg/kg)
	Analytical	MDL	RL	Screening Level		Soil			D1 4	Soil	Soil
Analyte	Method	(mg/kg)	(mg/kg)	(mg/kg)	Plants	Invertebrates	Avian	<u>Mammalian</u>	Plants	Microbes	Invertebrates
Metals											
Antimony	EPA 6010B	3	10	0.27 ^x		78		0.27	5		
Arsenic	EPA 6020A	0.06	0.5	18 [×]	18		43	46	10	100	60
Boron	EPA 6010B	0.4	10	0.5					0.5	20	
Cadmium	EPA 6020A	0.004	0.02	0.36	32	140	0.77	0.36	4	20	20
Chromium ^c	EPA 6020A	0.03	0.2	0.4			26	34	1	10	0.4
Cobalt	EPA 6020A	0.003	0.02	13	13	. 	120	230	20	1,000	
Copper	EPA 6020A	0.08	0.1	28	70	80	28	49	100	100	50
Manganese	EPA 6010B	0.04	2	220	220	450	4,300	4,000	500	100	
Mercury	EPA 7471A	0.002	0.02	0.1					0.3	30	0.1 ^d
Molybdenum	EPA 6010B	0.5	2	2					2	200	
Nickel	EPA 6020A	0.03	0.2	38	38	280	210	130	30	90	200
Selenium	EPA 6020A	0.2	1	0.52 ×	0.52	4.1	1.2	0.63	1.00	100	70
Silver	EPA 6020A	0.008	0.02	2	560		4.2	14	2	50	
Thallium	EPA 6020A	0.003	0.02	1					1		
Uranium	EPA 6020A	0.006	0.02	5					5		
Vanadium	EPA 6020A	0.02	0.2	2			7.8	280	2	20	
Zinc	EPA 6010B	0.3	2	46	160	120	46	79	50	100	200
Other											
тос	Walkley- Black	0.07%	0.2%								

Notes:

^a USEPA ecological soil screening levels (SSL); units are mg/kg, dry weight.

^b Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants (ORNL, 1997a), soil invertebrates and microbes (ORNL, 1997b).

^c Measured as total chromium; however, because chromium VI was not detected in soil samples, total chromium is assumed to be represented by chromium III.

^d Based on a LOEC of 0.5 mg/kg for reduction in soil invertebrate survival cocoon production with an applied safety factor of 5.

^x Laboratory RL is greater than lowest screening value.

TABLE 4-6

Target Analyte List, MDLs, RLs, and Ecological Risk Screening Levels for Riparian Soil (Page 2 of 2)

"--" - not available
LOEC - lowest observed effects concentation
MDL - method detection limit
mg/kg - milligrams per kilogram
ORNL - Oak Ridge National Laboratory
RL - reporting limit
SSL - soil screening level

TABLE 4-7

Target Analyte List, MDLs, RLs, and Ecological Risk Screening Levels for Sediment

	.			Pacific Northwest Regional SQG ¹
Analyte	Analytical Method	MDL (mg/kg)	RL (mg/kg)	(mg/kg)
Metals				
Antimony	EPA 6010B	3	10	
Arsenic	EPA 6020A	0.06	0.5	20
Boron	EPA 6010B	0.4	10	
Cadmium	EPA 6020A	0.004	0.02	1.1
Chromium	EPA 6020A	0.03	0.2	95
Cobalt	EPA 6020A	0.003	0.02	50 ³
Copper	EPA 6020A	0.08	0.1	80
Manganese	EPA 6010B	0.04	2	460 ³
Mercury	EPA 7471A	0.002	0.02	0.28
Molybdenum	EPA 6010B	0.5	2	
Nickel	EPA 6020A	0.03	0.2	60
Selenium	EPA 6020A	0.2	1	4 4
Silver	EPA 6020A	0.008	0.02	2.0
Thallium	EPA 6020A	0.003	0.02	
Uranium	EPA 6020A	0.006	0.02	
Vanadium	EPA 6020A	0.02	0.2	
Zinc	EPA 6010B	0.3	2	130
AVS/SEM	EPA-821-R-91-100			
Cadmium	EPA 6020A	nd	0.2	na
Copper	EPA 6020A	nd	0.4	na
Lead	EPA 6020A	nd	3	na
Mercury	EPA 7471A	nd	0.01	na
Nickel	EPA 6020A	nd	0.5	na
Zinc	EPA 6020A	nd	0.4	na

Notes:

ARCS - assessment and remediation of contaminated sediments

AVS/SEM - acid volatile sulfides/simultaneously extracted metals

LEL - lowest effects levels

MDL - method detection limit

mg/kg - milligrams per kilogram

MOE- Ministry of the Environment

nd - not determined

NOAA - National Oceanic and Atmospheric Administration

RL - reporting limit

SQG - sediment quality guidelines

TEL - threshold effects level

USACE - United States Army Corps of Engineers

souce of values is the Sediment Evaluation Framework for the Pacific Northwest, May 2009 Prepared by USACE et al. unless otherwise noted

² Great Lakes ARCS program TEL as cited in NOAA SQuiRT table (Buchman 2008)

³ Ontario MOE LEL as cited in NOAA SQuiRT table (Buchman 2008)

⁴ Screening value from Van Derveer and Canton (1997)

[&]quot;- -" - not available

TABLE 4-8

Target Analyte List, MDLs, RLs, and Ecological Risk Screening Levels for Surface Water
(Page 1 of 2)

				Proposed	State of Idaho	National	ORNL Toxi	cological Benc	hmarks
Analyte ¹	Analytical Method	MDL (mg/L)	RL (mg/L)	COPEC Screening Criteria (mg/l)	Standards ² Aquatic Life Chronic (mg/l)	Standards Aquatic Life ³ Chronic (mg/l)	Lowest Chronic Value ⁴ (mg/l)	Tier II SCV ⁵ (mg/I)	Lowest Population EC20 ⁶ (mg/l)
Antimony	EPA 6010B	0.003	0.010						
Arsenic	EPA 6020A	0.0001	0.0005	0.15	0.15 ^a	0.15			
Boron	EPA 6010B	0.002	0.010						
Cadmium	EPA 6020A	0.00002	0.000005	0.0006	0.0006 ^a	0.00025 b,c	0.00015		0.0043
Chromium ^c	EPA 6020A	0.00004	0.0002	0.011	0.074/0.011 a,d	0.074/0.011 b,d	<0.044		0.13
Cobalt	EPA 6020A	0.00002	0.000006						
Copper	EPA 6020A	0.00002	0.0001	0.011	0.011 ^a	BLM ^e	0.00023		0.00
Manganese	EPA 6010B	0.0002	0.0006	0.112			<1.1	0.12	0.112
Mercury	EPA 7470A	0.00002	0.0005			0.00077			
Molybdenum	EPA 6010B	0.0006	0.020						
Nickel	EPA 6020A	0.00003	0.001	0.052	0.052 ^a	0.052 ^b	< 0.005		0.215
Selenium	EPA 6020A	0.0003	0.001	0.005	0.005 ^f	0.0050 ⁹	0.088		
Silver	EPA 6020A	0.000004	0.00002						
Thallium	EPA 6020A	0.000005	0.00002						
Uranium	EPA 6020A	0.000003	0.00002	0.142			0.142	0.0026	0.027
Vanadium	EPA 6020A	0.00003	0.0002	0.02		 .	0.08	0.02	0.32
Zinc	EPA 6010B	0.0007	0.020	0.12	0.12 ^a	0.12 ^b	0.03		80.0

Notes:

¹ Monitoring parameters included in 2009 Surface Water Monitoring Sampling and Analysis Plan (MWH, 2009). Concentrations for all parameters are dissolved

² State of Idaho Surface Water Quality for Aquatic Life (IDAPA 58.01.02); Acute Criteria (CMC) and Chronic Criteria (CCC).

³ National Recommended Water Quality Criteria (USEPA, 2009); Freshwater Standards for Acute Criteria (CMC) and Chronic Criteria (CCC).

⁴ Lowest Chronic Value (LCV) observed in freshwater daphnids. Source: ORNL, 1996.

⁵ Tier II Secondary Chronic Value. Source: ORNL, 1996.

⁶ Lowest Population EC₂₀. Source: ORNL, 1996.

^a Aquatic life criteria for these metals are expressed as a function of total hardness (mg/L as calcium carbonate), the pollutant's water effect ratio (WER) as defined in Subsection 210.03.c.iii of IDAPA 58.01.02 and multiplied by an appropriate dissolved conversion factor as defined in Subsection 210.02. For comparative purposes only, the values displayed in this table are shown as dissolved metal and correspond to a total hardness of 100 mg/L and a WER of 1.0.



Target Analyte List, MDLs, RLs, and Ecological Risk Screening Levels for Surface Water (Page 2 of 2)

- b The freshwater criterion for this metal is expressed as a function of hardness (mg/L) in the water column. The value given here corresponds to a hardness of 100 mg/L. Criteria values for other hardness may be calculated from the following: CMC (dissolved) = exp {mA[ln(hardness)]+bA} (CF), or CCC (dissolved) = exp {mC[ln(hardness)]+bC} (CF) and the parameters specified in Appendix B Parameters for Calculating Freshwater Dissolved Metals Criteria That Are Hardness-Dependent.
- ^c Reporting limit (RL) is greater than screening value, but method detection limit (MDL) is less than the screening value.
- ^d Values specified are for chromium III/VI. If data are screened against these standards, then the total chromium results will be compared to the chromium VI standard.
- e Freshwater criteria calculated using the BLM mm See Document (epa.gov/waterscience/criteria/copper/).
- ^f Criterion is expressed as total recoverable (unfiltered) concentration.
- ⁹ The CMC = 1/[(f1/CMC1)+(f2/CMC2)] where f1 and f2 are the fractions of total selenium that are treated as selenite and selenate, respectively, and CMC1 and CMC2 are 0.1859 mg/L and 0.01282 mg/L, respectively.

"- -" - not available

CCC - Criterion Chronic Concentration

CMC - Chronic Maximum Concentration

COPEC - chemicals of potential ecological concern

CWA - Clean Water Act

IDAPA Idaho Administrative Procedures Act

IDEQ - Idaho Department of Environmental Quality

MDL - method detection limit

mg/L - milligrams per liter

ORNL - Oak Ridge National Laboratory

RL - reporting limit

RMP - Resource Management Plan

SCV - secondary chronic values

USEPA - United States Environmental Protection Agency

TABLE 4-9
SUMMARY OF CALIBRATION AND QC PROCEDURES FOR EPA METHOD 6020A (ICPMS)
(Page 1 of 4)

Quality Control Check	Minimum Frequency	Acceptance Criteria	Corrective Action/Lab Flagging Criteria	Data Validation Reference Section ^a	Data Validation Qualification ^b
MS tuning sample	Prior to initial calibration, solution as specified in Section 7.10 of method (e.g., ⁷ Li, ⁵⁹ Co, ¹¹⁵ In, and ²⁰⁵ TI)	Mass calibration ≤ 0.1 amu from the true value. Resolution < 0.9 amu full width at 10% peak height. Stability: RSD ≤ 5% for at least three replicate analysis.	Retune instrument then reanalyzing tuning solution.	Per Section II of ICP-MS NFG, except substitute with method acceptance limits.	RSD > 5% = J/UJ (professional judgment on criteria related to non-target analytes).
Initial calibration (ICAL) for all target analytes (minimum one standard and a blank)	Daily initial calibration prior to sample analysis	If more that one standard is used, correlation coefficient (r) ≥ 0.995	Correct problem then repeat initial calibration.	Per Section III of ICP-MS NFG.	r < 0.995 = J/UJ
Initial Calibration Verification (ICV)	After ICAL, before beginning a sample run (at a concentration other than used for calibration and from a second source)	All analytes within ±10% of expected value	Correct problem and verify second source standard. Rerun ICV. If that fails, correct problem and repeat ICAL.	Per Section III of ICP-MS NFG.	%R < 90 or >110% = J/UJ
Initial Calibration Blank (ICB)	After ICV	No analyte detected ≥ RL	Correct problem and reanalyze.	Per Section IV of ICPMS NFG, except U at detected value if result > MDL < RL.	Per Table 14 in NFG, except U at detected value if result > MDL < RL.

SUMMARY OF CALIBRATION AND QC PROCEDURES FOR EPA METHOD 6020A (ICPMS) (Page 2 of 4)

Quality Control Check	Minimum Frequency	Acceptance Criteria	Corrective Action/Lab Flagging Criteria	Data Validation Reference Section ^a	Data Validation Qualification b
Low-Level Calibration Check Standard (LLCCS)	Daily, after ICAL (at a concentration ≤ RLs).	The analyte(s) within ±30% of expected value.	Correct problem then reanalyze.	Per Section III of ICP-MS NFG.	%R < 70% or > 130% (%R < 50% or > 150% for Co, Mn, or Zn) = J/UJ
Interference Check Solution A & AB (ICS-A & ICS-AB)	At the beginning of an analytical run or once during a 12- hour period, whichever is more frequent	ICS-A: All non-spiked analytes < 2X MDL. ICS-AB: Within ± 20% of expected value.	Correct problem and reanalyze ICS-A and ICS-AB.	Per Section III of ICP-MS NFG.	ICS < 80% or > 120% = J/UJ
Continuing Calibration Verification (CCV)	After every 10 samples and at the end of the analysis sequence (at a mid- calibration range concentration)	The analyte within ±10% of expected value	Correct problem then repeat CCV and reanalyze all samples since last successful CCV.	Per Section III of ICP-MS NFG.	CCV < 90 or > 110% = J/UJ
Continuing Calibration Blank (CCB)	Before beginning a sample run, after every 10 samples, and at end of the analytical sequence	No analyte detected ≥ RL	Correct problem then reanalyze calibration blank and previous 10 samples. Apply "B" flag to all associated positive results for the specific analyte(s) as appropriate.	Per Section IV of ICPMS NFG, except U at detected value if result > MDL < RL.	Per Table 14 in NFG, except U at detected value if result > MDL < RL.
Method blank (or preparation blank)	One per analytical batch	No analyte detected ≥ RL	Assess data. Correct problem. If necessary, reprep and analyze method blank and all samples processed with the contaminated blank. Apply B-flag to all associated positive results for the	Per Section IV of ICPMS NFG, except U at detected value if result > MDL < RL.	Per Table 14 in NFG, except U at detected value if result > MDL < RL.

TABLE 4-9
SUMMARY OF CALIBRATION AND QC PROCEDURES FOR EPA METHOD 6020A (ICPMS)
(Page 3 of 4)

Quality Control Check	Minimum Frequency	Acceptance Criteria	Corrective Action/Lab Flagging Criteria	Data Validation Reference Section ^a	Data Validation Qualification ^b
			specific analyte(s) in the preparation batch.		
Laboratory Control Sample (LCS) for all analytes	One LCS per analytical batch	Vendor-specified or laboratory-determined control limits (but not wider than 80-120% recovery). If LCS/LSC duplicate (LCSD) used, then use RPD ≤ 20.	Correct problem then reanalyze. If still out, re-prepare and reanalyze the LCS and all samples in the preparation batch.	Per Section VI of ICP-MS NFG, except substitute 80-120% recovery and ≤ 20 RPD limits.	%R < 80 or > 120% for water = J/UJ; < 50% = J detects, R non-detects
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	One MS/MSD per every 20 samples per matrix	Laboratory-determined control limits (but not wider than 75-125% recovery and RPD ≤ 20).	Flag associated sample results and perform post-digestion spike addition.	Per Section VIII of ICP-MS NFG, except substitute 75-125% recovery and ≤ 20 RPD limits.	%R < 75 or > 125% for water = J/UJ; < 30% = J detects, R non-detects. Water RPD <20%, soil < 35%. Low level (< 5 X RL, use ± RL water, 2 X RL for soil). For MS, if %R < 30% and post spike< 75% or not run, J detects, R non-detects. If post spike > 75 %, UJ non-detects.
Post-digestion spike addition	If MS/MSD fails	Recovery within 75-125% of expected results.	Perform dilution test.	Not applicable	None; see dilution test.
Serial dilution (SD) test	One SD sample per every 20 samples (required for samples containing concentrations > 50 X MDL)	Fivefold (1+4) dilution must agree within ±10% of the original determination.	Flag associated sample results and discuss in case narrative.	Per Section IX of ICPMS NFG.	%D < 90 > 110% = J/UJ

SUMMARY OF CALIBRATION AND QC PROCEDURES FOR EPA METHOD 6020A (ICPMS) (Page 4 of 4)

Quality Control Check	Minimum Frequency	Acceptance Criteria	Corrective Action/Lab Flagging Criteria	Data Validation Reference Section ^a	Data Validation Qualification ^b
Internal Standards (ISs)	Every sample; internal standards selected from list specified in Section 1.4 of method.	IS intensity ≥ 70% < 130% of intensity of the IS in the ICAL.	Perform corrective action as described in Section 9.6 of method.	Per Section X of ICP-MS NFG, except substitute 70-130 % limits.	IS %R < 70% > 130 % = J/UJ
Concentrations between the MDL and RL	All samples	Not applicable	Flag as estimated value ("J" flag)	Not applicable	Not applicable

National Functional Guidelines (NFG) for Inorganic Data Review (USEPA, 2004).
 Refer to NFG for detailed evaluation protocols.

ICPMS – inductively coupled plasma/mass spectrometry

MDL - method detection limit

RL – reporting limit

RPD - relative percent difference

RSD – relative standard deviation

TABLE 4-10

SUMMARY OF CALIBRATION AND QC PROCEDURES FOR EPA METHOD 6010B/C (ICP)
(Page 1 of 3)

Quality Control Check	Minimum Frequency	Acceptance Criteria	Corrective Action/Lab Flagging Criteria	Data Validation Reference Section ^a	Data Validation Qualification ^b
Initial calibration (ICAL) for all target analytes (minimum one standard and a blank)	Daily initial calibration prior to sample analysis	If more that one standard is used, correlation coefficient (r) ≥ 0.995	Correct problem then repeat initial calibration.	Per Section II of ICP NFG.	r < 0.995 = J/UJ
Initial Calibration Verification (ICV)	After ICAL, before beginning a sample run (at a concentration other than used for calibration and from a second source)	All analytes within ±10% of expected value	Correct problem and verify second source standard. Rerun ICV. If that fails, correct problem and repeat ICAL.	Per Section II of ICP NFG.	%R < 90 or >110% = J/UJ
Initial Calibration Blank (ICB)	After ICV	No analyte detected ≥ RL	Correct problem and reanalyze.	Per Section III of ICP NFG, except U at detected value if result > MDL < RL.	Per Table 4 in NFG, except U at detected value if result > MDL < RL.
Low-Level Calibration Check Standard (LLCCS)	Daily, after ICAL (at a concentration ≤ RLs).	The analyte(s) within ±30% of expected value.	Correct problem then reanalyze.	Per Section II of ICP NFG.	%R < 70% or > 130% (%R < 50% or > 150% for Sb, Pb, Tl) = J/UJ
Interference Check Solution A & AB (ICS-A & ICS-AB)	At the beginning of an analytical run	ICS-A: All non-spiked analytes < 2X MDL. ICS-AB: Within ± 20% of expected value.	Correct problem and reanalyze ICS-A and ICS-AB.	Per Section IV of ICP NFG.	ICS < 80% or > 120% = J/UJ

SUMMARY OF CALIBRATION AND QC PROCEDURES FOR EPA METHOD 6010B/C (ICP) (Page 2 of 3)

Quality Control Check	Minimum Frequency	Acceptance Criteria	Corrective Action/Lab Flagging Criteria	Data Validation Reference Section ^a	Data Validation Qualification b
Continuing Calibration Verification (CCV)	After every 10 samples and at the end of the analysis sequence (at a mid-calibration range concentration)	The analyte within ±10% of expected value	Correct problem then repeat CCV and reanalyze all samples since last successful CCV.	Per Section II of ICP NFG.	CCV < 90 or > 110% = J/UJ
Continuing Calibration Blank (CCB)	Before beginning a sample run, after every 10 samples, and at end of the analytical sequence	No analyte detected ≥ RL	Correct problem then reanalyze calibration blank and previous 10 samples. Apply "B" flag to all associated positive results for the specific analyte(s) as appropriate.	Per Section III of ICP NFG, except U at detected value if result > MDL < RL.	Per Table 4 in NFG, except U at detected value if result > MDL < RL.
Method blank (or preparation blank)	One per analytical batch	No analyte detected ≥ RL	Assess data. Correct problem. If necessary, reprep and analyze method blank and all samples processed with the contaminated blank. Apply B-flag to all associated positive results for the specific analyte(s) in the preparation batch.	Per Section III of ICP NFG, except U at detected value if result > MDL < RL.	Per Table 4 in NFG, except U at detected value if result > MDL < RL.
Laboratory Control Sample (LCS) for all analytes	One LCS per analytical batch	Vendor-specified or laboratory-determined control limits (but not wider than 80-120% recovery). If LCS/LSC duplicate (LCSD) used, then use RPD ≤ 20.	Correct problem then reanalyze. If still out, re-prepare and reanalyze the LCS and all samples in the preparation batch.	Per Section V of ICP NFG, except substitute 80-120% recovery and ≤ 20 RPD limits.	%R < 80 or > 120% for water = J/UJ; < 50% = J detects, R non-detects

TABLE 4-10 SUMMARY OF CALIBRATION AND QC PROCEDURES FOR EPA METHOD 6010B/C (ICP) (Page 3 of 3)

Quality Control Check	Minimum Frequency	Acceptance Criteria	Corrective Action/Lab Flagging Criteria	Data Validation Reference Section ^a	Data Validation Qualification ^b
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	One MS/MSD per every 20 samples per matrix	Laboratory-determined control limits (but not wider than 75-125% recovery and RPD ≤ 20).	Flag associated sample results and perform post-digestion spike addition.	Per Section VII of ICP NFG, except substitute 75-125% recovery and ≤ 20 RPD limits.	%R < 75 or > 125% for water = J/UJ; < 30% = J detects, R non-detects. Water RPD <20%, soil < 35%. Low level (< 5 X RL, use ± RL water, 2 X RL for soil). For MS, if %R < 30% and post spike< 75% or not run, J detects, R non-detects. If post spike > 75 %, UJ non-detects.
Post-digestion spike addition	If MS/MSD fails	Recovery within 75-125% of expected results.	Perform dilution test.	Not applicable	None; see dilution test.
Serial dilution (SD) test	One SD sample per every 20 samples (required for samples containing concentrations > 50 X MDL)	Fivefold (1+4) dilution must agree within ±10% of the original determination.	Flag associated sample results and discuss in case narrative.	Per Section VIII of ICP NFG.	%D < 90 > 110% = J/UJ
Concentration s between the MDL and RL	All samples	Not applicable	Flag as estimated value ("J" flag)	Not applicable	Not applicable

National Functional Guidelines (NFG) for Inorganic Data Review (USEPA, 2004).
 Refer to NFG for detailed evaluation protocols.

ICP - inductively coupled plasma-atomic emission spectrometry MDL - method detection limit RL - reporting limit

RPD – relative percent difference %R – percent recovery



SUMMARY OF CALIBRATION AND QC PROCEDURES FOR EPA METHOD 7470A/7471A (CVAA) (Page 1 of 3)

Quality Control Check	M inimum Frequency	Acceptance Criteria	Corrective Action/Lab Flagging Criteria	Data Validation Reference Section ^a	Data Validation Qualification ^b
Initial calibration (ICAL) for all target analytes (minimum five standards and a blank)	Daily initial calibration prior to sample analysis	Blank plus five calibration concentrations, correlation coefficient (r) ≥ 0.995	Correct problem then repeat initial calibration.	Per Section II of AA NFG.	r < 0.995 = J/UJ
Initial Calibration Verification (ICV)	After ICAL, before beginning a sample run (at a concentration other than used for calibration and from a second source)	All analytes within ±10% of expected value	Correct problem and verify second source standard. Rerun ICV. If that fails, correct problem and repeat ICAL.	Per Section II of AA NFG.	%R < 80 or >120% = J/UJ
Initial Calibration Blank (ICB)	After ICV	No analyte detected ≥ RL	Correct problem and reanalyze.	Per Section III of AA NFG, except U at detected value if result > MDL < RL.	Per Table 24 in NFG, except U at detected value if result > MDL < RL.
Low-Level Calibration Check Standard (LLCCS)	Daily, after ICAL (at a concentration ≤ RLs).	The analyte(s) within ±30% of expected value.	Correct problem then reanalyze.	Per Section II of AA NFG.	%R < 70% or > 130% = J/UJ
Continuing Calibration Verification (CCV)	After every 10 samples and at the end of the analysis sequence (at a mid-calibration range concentration)	The analyte within ±10% of expected value	Correct problem then repeat CCV and reanalyze all samples since last successful CCV.	Per Section II of AA NFG.	CCV < 80 or > 120% = J/UJ

TABLE 4-11

SUMMARY OF CALIBRATION AND QC PROCEDURES FOR EPA METHOD 7470A/7471A (CVAA) (Page 2 of 3)

Quality Control Check	M inimum Frequency	Acceptance Criteria	Corrective Action/Lab Flagging Criteria	Data Validation Reference Section ^a	Data Validation Qualification ^b
Continuing Calibration Blank (CCB)	Before beginning a sample run, after every 10 samples, and at end of the analytical sequence	No analyte detected ≥ RL	Correct problem then reanalyze calibration blank and previous 10 samples. Apply "B" flag to all associated positive results for the specific analyte(s) as appropriate.	Per Section III of AA NFG, except U at detected value if result > MDL < RL.	Per Table 24 in NFG, except U at detected value if result > MDL < RL.
Method blank (or preparation blank)	One per analytical batch	No analyte detected ≥ RL	Assess data. Correct problem. If necessary, reprep and analyze method blank and all samples processed with the contaminated blank. Apply B-flag to all associated positive results for the specific analyte(s) in the preparation batch.	Per Section III of AA NFG, except U at detected value if result > MDL < RL.	Per Table 24 in NFG, except U at detected value if result > MDL < RL.
Laboratory Control Sample (LCS) for all analytes	One LCS per analytical batch	Vendor-specified or laboratory-determined control limits (but not wider than 80-120% recovery). If LCS/LSC duplicate (LCSD) used, then use RPD ≤ 20.	Correct problem then reanalyze. If still out, re-prepare and reanalyze the LCS and all samples in the preparation batch.	Per Section IV of AA NFG, except substitute 80-120% recovery and ≤ 20 RPD limits.	%R < 80 or > 120% for water = J/UJ; < 50% = J detects, R non-detects
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	One MS/MSD per every 20 samples per matrix	Laboratory-determined control limits (but not wider than 75-125% recovery and RPD ≤ 20).	Flag associated sample results and perform post-digestion spike addition.	Per Section VI of AA NFG, except substitute 75-125% recovery and ≤ 20 RPD limits.	%R < 75 or > 125% for water = J/UJ; < 30% = J detects, R non-detects. Water RPD <20%, soil < 35%. Low level (< 5 X RL, use <u>+</u> RL water, 2 X



SUMMARY OF CALIBRATION AND QC PROCEDURES FOR EPA METHOD 7470A/7471A (CVAA) (Page 3 of 3)

Quality Control Check	Minimum Frequency	Acceptance Criteria	Corrective Action/Lab Flagging Criteria	Data Validation Reference Section ^a	Data Validation Qualification ^b
					RL for soil). For MS, if %R < 30% and post spike< 75% or not run, J detects, R non-detects. If post spike > 75 %, UJ non-detects.
Concentration s between the MDL and RL	Ali samples	Not applicable	Flag as estimated value ("J" flag)	Not applicable	Not applicable

National Functional Guidelines (NFG) for Inorganic Data Review (USEPA, 2004).
 Refer to NFG for detailed evaluation protocols.

AA – atomic absorption CVAA - cold vapor atomic absorption MDL – method detection limit RL - reporting limit RPD - relative percent difference %R - percent recovery

TABLE 5-1 PROJECT CONTACTS						
Company or Agency	Contact Title		Telephone			
	Barry Koch	Special Project Lead— Mining / Program Manager	208-547-1439			
P4 Production	Bob Geddes	Environmental Regulatory Specialist / Management Support	208-547-1234			
USEPA	Dave Tomten	Remedial Project Manager	208-378-5763			
	Vance Drain	MWH Project Manager	801-617-3250			
	Ruth Siegmund	Project Chemist	925-627-4756			
MWH .	Leah Wolf Martin	RI/FS Task Manager	970-879-6260			
	Leland Fuhrig	On-Site Safety Officer	970-879-6260			
	Celeste Christensen	Project Coordinator	425-896-6969			
Columbia Analytical Services, Inc.	Greg Salata	Project Manager (primary laboratory)	360-577-7222			
Laboratory Data Consultants, Inc	Linda Rauto	Project Manager (data validation subcontractor)	760-634-0437			

APPENDICES

Appendix A

Standard Operating Procedures

SOP-NW-9.3 COLLECTION OF SEDIMENT SAMPLES



SOP-NW-9.3

Collection of Sediment Samples

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1.0 PURPOSE AND SCOPE

The purpose of this document is to define the standard operating procedures (SOPs) for the collection and handling of sediment samples. This SOP applies to any work performed by MWH or subcontractor personnel for any portion of sediment sampling, and is intended to be used in conjunction with site-specific work plans or sampling and analysis plans (SAPs). Modifications to this SOP may be made with the approval of the program manager and the quality assurance (QA) manager.

2.0 **DEFINITIONS**

None.

3.0 RESPONSIBILITIES

3.1 Field Sampling Team Member

The field sampling team member is responsible for sample collection, sample custody in the field, sample preservation, field testing, total and accurate completion of data sheets, sample shipment and delivery of data to the project manager and designated project secretary, all as described in this technical procedure. All staff are responsible for reporting deviations or nonconformance of the procedure to the field team leader, project manager, program manager, or QA manager, in compliance with the governing work plan or SAP requirements.

3.2 Field Team Leader

The field team leader is responsible for supervising the field sampling team members. Supervision includes ensuring that samples are collected, documented, preserved, field analyzed, handled, and shipped to the appropriate laboratory as specified in project work planning documents and this technical procedure.

3.3 Project Manager

The project manager has overall management responsibilities for the project, is responsible for designing the sampling program, for arranging the logistics of the program, and for providing any required clarifications in the use of this procedure. The project manager may assume the responsibilities of the field team leader on smaller projects.

The project manager is also responsible for maintaining project files and filing project documents, project correspondence, chain of custody forms, sediment sampling forms, generated data, and other associated and pertinent project information.

The project manager is also responsible for reporting project status to the program manager and obtaining permission from the program manager for any changes to the SOP.

3.4 Program Manager

The program manager has overall management responsibilities for the program and will advise project managers on design and logistics. The program manager is also responsible for reviewing and approving SOPs.

3.5 QA Manager

The QA manager is responsible for developing and managing procedures outlined in the SOPs and in site-specific SAPs, QA plans, and/or workplans.

4.0 DISCUSSION

The methods described by this procedure may be used to acquire sediment samples for chemical or radiological analysis. Methods should be selected at the discretion of the field team leader or project manager or program manager in accordance with any specific provisions of governing SAPs or work plans.

5.0 PROCEDURE

The sampling methods described in this SOP are suitable for collecting sediment samples that may be contained within the upper layers of the streambeds, seeps, or in reservoir or standing water locations (ponds). Because of the potentially high degree of heterogeneity found in sediments, the collection of representative samples requires careful planning and considerable technical judgment. Sampling locations shall be as specified in the governing work plan or SAP. However, in general, the preferred sampling strategy requires collection of a minimum of three samples from a specified sample location and compositing those samples in the field to form a single composite sample before shipment.

The methods defined in this SOP should not be used for sediment collection under dangerous flood conditions, and assumes that field personnel can safely wade a stream or sample from the shore of a stream or pond location unless a boat is to be used. All work under this SOP must be done in full conformance with the governing health and safety plan.

5.1 Equipment List

The following is a list of required field equipment for performing sediment sampling:

- Bound field notebook;
- Copy of this SOP and applicable work plan or SAP;
- Decontamination equipment;
- Detergent solution
- Distilled or deionized water;
- Hand-operated sediment collection device or devices as specified in the work plan or SAP;
- Sample containers;
- Sample labels and seals;
- Site map of sampling area;
- Sediment sample collection form (see attachment)

• Stainless steel mixing bowl and spoon

The governing work plan or SAP may require the use of other equipment based on the scope and objective of an individual project. Project personnel will review the work plan or SAP for any equipment not listed in this SOP.

5.2 Sediment Sampling

A scooping method will be used to collect sediment samples from streams, stock ponds, or dump seeps. Streambed materials can vary spatially and temporally and can range in size from cobbles and boulders to clay. The field technicians will evaluate the site based on conditions and particle sizes, and will record site conditions and particle sizes in a field logbook as well as on the attached form. Three samples will be collected at each stream, stock pond or dump seep location and combined to form a composite sample. Sediment samples will be collected from the top approximately four inches of sediment column or (0-10 cm). Large debris will be removed and, after being shaken lightly to dislodge adhered sediment into the sample container, disposed and not included with the sample. The three sample increments will be collected using a stainless steel or polyethylene scoop or similar and held in bags for compositing. In the case of rivers too deep to wade, three sediment samples will be collected along the nearshore, from downstream to upstream.

The ponds will be accessed by wading and sampled using a dredge (e.g., petite-Ponar) sampling apparatus or similar. The Ponar dredge will be opened and lowered until it contacts the sediment bottom. Field personnel will retrieve the Ponar dredge using a steady pulling motion to ensure closure of the dredge. Any washout of sediment samples (the Ponar does not completely close during retrieval) will require resampling. The Ponar will be placed upright and the top four inches of sediment will be removed and placed in a 1-gallon ziploc bag. Each pond sediment sample will be a composite of three increments (e.g., three discrete grab samples). Larger debris will be removed from each sample that is collected and will be shaken lightly to dislodge adhered sediments (that have adhered to the surface of the debris) into the bowl, then discarded before the sediment is held in bags for compositing.

The selection of sampling locations, including sample locations, shall be as specified in the applicable work plan or SAP. The sampling site shall be photographed if so specified in the governing workplan or SAP. Samples will be composited at each sample location directly after collection; compositing is described in Section 5.2.1. In addition, to remove residual organic matter and large sediment particles, each sediment sample designated for trace metals analysis may be sieved by the laboratory, if required by the governing work plan or SAP. The laboratory sieve procedure is described in Section 5.2.2.

Typical steps to be followed in collecting sediments are:

- Decontamination of sampling equipment prior to use in compliance with the governing work plan or SAP.
- Place sampling equipment on clean plastic sheeting near the sampling locations.
- Collect samples in streams, ponds, seeps, or reservoir deltas.

- Composite the samples. Use the compositing procedure described in Section 5.2.1.
- Fill sample containers as discussed in Section 5.3.
- Seal and label sampling containers and place on ice in coolers, described in Section 5.3.
- Decontaminate all sediment sampling equipment as outlined in Section 5.4.

5.2.1 Compositing

If sediment samples are collected at a particular location, the following procedure will be used for compositing:

- Combine all samples in a decontaminated stainless steel mixing bowl.
- Obtain sufficient sampling containers to retain all of the sediment composite sample.
- Remove material other than sediment if sieving did not occur, such as litter, root matter, and rocks. Shake sediment from such materials to retain sediment in the sample before discarding the undesired material.
- After placing the composited sediment sample in sampling containers, apply labeling.

5.2.2 Sieving

Sediment collected for laboratory analysis shall be sieved by the analytical laboratory under more ideal conditions. Sieving will also occur in conjunction with weighing, homogenization, drying, and grinding before analysis is performed as described below.

Drying. The laboratory will determine the initial percent solids on each soil sample as received (the initial percent solids will be reported only, and not used to correct the metal results). Each soil sample will be air dried at room temperature to a constant weight, or to a final percent solids level of at least 99 percent.

Sieving and Grinding. Crush the dry soil using a gloved hand and sieve the material through a No. 10 (2mm) sieve. Discard the sticks, stones, or extraneous matter not passing the sieve. Grind the sieved soil using a glass (or agate) mortar and pestle or similar device, and transfer to a labeled container.

After this sample preparation, the laboratory analyst will mix the sieved sample and take a representative sub-sample of at least 1.0 g, weighted to the nearest 0.01 g, for the digestion procedures.

5.3 Sample Handling

Sample handling procedures and chain of custody requirements shall be as specified in the governing work plan or SAP. Typical handling procedures for sediment samples are as follows:

- If specified in the site work plan or SAP, a photograph should be taken of the sediment sample.
- Using a decontaminated stainless steel scoop, place the sediment sample in a 1-gallon ziploc bag. If necessary, use more than one additional ziploc bags, and apportion the sample equally among each 1-gallon ziploc bag. The sediment sample bags shall be appropriately labeled and include sample identification and analysis to be performed in accordance with the governing work plan or SAP.
- Place each sediment sample bag in an additional 1-gallon ziploc bag, or more, as required to prevent leakage and bursting of sediment sample bags during shipping.
- Store sediment sample bags in coolers for transportation in compliance with the sample handling and chain of custody requirements specified in the work plan or SAP.
- Sample documentation and labeling requirements shall be as specified in the governing work plan or SAP.

During sediment sampling operations, the proper personal protective equipment will be worn, as described in the applicable work plan or site safety and health plan to minimize cross-contamination and ensure the safety of sampling personnel.

5.4 Decontamination

Sample acquisition and compositing tools shall be decontaminated as follows:

- 1. Ensure that the cleaning solutions and rinseate containers required by governing sampling plans are available
- 2. Scrub the sample acquisition or compositing tool with a brush and rinse with deionized or distilled water.
- 3. Dispose of the rinseate and wiping rags in the manner specified in governing sampling plans.
- 4. Wrap the decontaminated device securely in clean plastic sheeting or bags pending next use.

6.0 REFERENCES

- Environmental Protection Agency. 1986. <u>Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual.</u> EPA Region IV Environmental Services Division, Athens, GA.
- Environmental Protection Agency. 1988. <u>Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final</u>. Environmental Protection Agency, Washington, D.C.
- Guy, Harold P. 1978. <u>Techniques of Water-Resources Investigations of the United States Geological Survey.</u> Book 3: Applications of Hydraulics; Chapter C1, Fluvial Sediment Concepts. U.S. Government Printing Office, Washington, D.C.
- Guy, Harold P. and Vernon W. Norman. 1976. <u>Techniques of Water-Resources Investigations of the United States Geological Survey. Book 3: Applications of Hydraulics; Chapter C2, Field Methods for Measurement of Fluvial Sediment.</u> U.S. Government Printing Office, Washington, D.C.
- U.S. Geological Survey. 1977. <u>National Handbook of Recommended Methods for Water-Data Acquisition</u>. Department of the Interior, Office of Water Data Collection, Washington, D.C.
- U.S. Geological Survey. 1978. <u>Techniques of Water-Resources Investigations of the United States</u>
 <u>Geological Survey. Book 5: Laboratory Analysis; Chapter C1, "Laboratory Theory and Methods for Sediment Analysis.</u> U.S. Government Printing Office, Washington, D.C.

Project: P4 Sediment and Riparian Soil Investigation	Project Number: <u>5020092.11603</u>				
Date: / /2010 Time:	Signatures:				
SITE DESCRIPTION					
Site Location:	1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-				
Station Number: M Photo. No.:					
GPS Coordinates: Latitude ° ′					
(NAD27) Elevation					
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FIELD DESCRIPTION					
Sample Identification Number:					
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Collection Method: SCOOP PONAR OTHER:	-				
Comments/Descriptions:					
					
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SOP-NW-7.2 COLLECTION OF SOIL SAMPLES



SOP-NW-7.2 Collection of Soil Samples

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1.0 PURPOSE AND SCOPE

The purpose of this document is to define the standard operating procedures (SOP) for the collection and handling of soil samples using hand operated devices. This SOP does not describe sampling procedures for lithified deposits or rocks or sampling procedures using drill rigs. This SOP applies to any work performed by MWH or subcontractor personnel for any portion of soil sampling and is intended to be used in conjunction with site-specific workplans or sampling and analysis plans (SAPs). Modifications to this SOP may be made with the approved by the Project Manager or Task Leader and the Quality Assurance (QA) Manager.

2.0 **DEFINITIONS**

None.

3.0 HEALTH AND SAFETY WARNINGS

Safety glasses should be worn at all times when taking soil samples to protect from dust particles. Care should be taken to minimize the disruption of the soil to minimize dust. A deionized water spray bottle may be used to dampen the earth and minimize dust if necessary.

4.0 RESPONSIBILITIES

4.1 Field Sampling Engineer

The Field Sampling Engineer (or field team member) is responsible for sample collection, sample custody in the field, sample preservation, field testing, total and accurate completion of data sheets, sample shipment and delivery of data to the Project Manager and designated project secretary, all as described in this technical procedure. All staff are responsible for reporting deviations or nonconformance of the procedure to the Field Team Leader, Project Manager, or Quality Assurance

4.2 Field Team Leader

The Field Team Leader is responsible for supervising the Field Sampling Engineers. Supervision includes ensuring that samples are collected, documented, preserved, field analyzed, handled and shipped to the appropriate laboratory as specified in project work documents and this technical

4.3 Project Manager

The Project Manager has overall management responsibilities for the project, is responsible for designing the sampling program, for arranging the logistics of the program, and for providing any required clarifications in the use of this procedure. The Project Manager may assume the responsibilities of the Field Team Leader on smaller projects.

The Project Manager is also responsible for maintaining project files and filing project documents, project correspondence, chain of custody forms, soil sampling forms, generated data, and other associated and pertinent project information.

4.4 QA Manager

The QA Manger is responsible for developing and managing procedures outlined in the SOPs and in site specific SAPs, QA plans, and/or workplans.

5.0 DISCUSSION

The methods described by this procedure may be used to acquire soil samples for chemical or radiological analysis. Methods should be selected at the discretion of the Field Team Leader or Project Manager in accordance with any specific provisions of governing SAPs, QA plans, and/or workplans.

6.0 PROCEDURE

The sampling method described in this SOP is suitable for collecting soil samples. Because of the potentially high degree of heterogeneity found in soils, the collection of representative samples requires careful planning and considerable technical judgment. Sampling locations shall be as specified in the governing workplan or SAP. However, the preferred sampling strategy requires collection of subsamples from the specified sample location and compositing of those subsamples in the field to form a single sample before shipment.

6.1 Equipment List

The following is a list of required field equipment for performing sediment sampling:

- · Copy of this SOP and applicable workplan or SAP
- Bound field notebook
- Sterilized latex or nitrile gloves
- Decontamination equipment and waste containers
- Detergent solution (0.1 to 0.3 percent Alconox or equivalent detergent)
- Distilled or deionized water
- Hand-operated soil collection device
- 100-ft measuring tape
- Sample bags
- Sample containers
- Sample labels and seals
- U.S. Standard Sieve No. 10 with collection pan and cover (optional)
- Site map of sampling area
- Soil sample collection form (see attachment)
- Soil coring device
- Stainless steel mixing bowl
- Stainless steel spoon or hand shovel

Criteria for selecting appropriate soil samples will follow ASTM Standard D 4700-91, Standard Guide for Soil Sampling from the Vadose Zone (ASTM, 1998).

6.2 General Considerations

The selection of sampling locations shall be as specified in the applicable workplan or SAP. The sampling site shall be photographed if so specified in the governing workplan or SAP. Samples will be composited in a manner specific to each sample location; compositing is described in Section 6.2.1. In addition, to remove residual organic matter and large soil particles, each soil sample designated for trace metals analysis may be sieved prior to shipment, if required by the governing workplan or SAP. The sieve procedure is described in Section 6.2.2. During soil sampling operations, the proper personal protective equipment will be worn, as described in the applicable workplan or site safety and health plan.

6.3 Soil Sampling

The procedures for collecting one soil sample at a given location is as follows:

- Using decontaminated sampling equipment under the protocols described in Section 6.5, collect soil from the interval of concern or to refusal of the equipment.
- If the equipment is refused, record the depth of refusal.
- Retain the soil in a Ziplock® bag, sampling container or decontaminated, stainless steel mixing bowl for further compositing.

Composite soil samples will be collected by carefully removing the top layer of soil to the desired sample depth with a decontaminated spade, shovel, or equivalent. Soil samples will be collected from 0-6 inches below ground surface (bgs). The three sample increments will be collected using a stainless steel or polyethylene scoop and held in bags for compositing. Larger debris will be removed from each sample that is collected and will be shaken lightly to dislodge adhered sediments (that have adhered to the surface of the debris) into the bowl, then discarded before the soil is composited using a stainless steel spoon. Once compositing is complete as discussed in Section 6.3.1, the soil sample will be placed into sample container or heavy duty, 1-gallon Ziploc® storage bag.

6.3.1 Compositing

If soil samples are collected at a particular location, the following procedure will be used for compositing:

- Combine each sample in a decontaminated stainless steel mixing bowl.
- Mix the contents of the mixing bowl for several minutes.
- Remove material other than soil, such as litter, root matter, and rocks. Shake soil material from roots and sod.
- Mix again for several minutes to obtain a homogeneous mixture.
- Fill designated sample containers with the homogenized soil mixture as discussed in Section 6.5

• Retain or dispose of the remaining soil mixture as specified in the applicable workplan or SAP.

Homogenization of samples may also occur at the analytical laboratory, per the governing workplan or SAP. Thus, field homogenization would not be necessary.

6.3.2 Sieving

Sediment collected for laboratory analysis shall be sieved by the analytical laboratory under more ideal conditions. Sieving will also occur in conjunction with weighing, homogenization, drying, and grinding before analysis is performed as described below.

Drying. The laboratory will determine the initial percent solids on each soil sample as received (the initial percent solids will be reported only, and not used to correct the metal results). Each soil sample will be air dried at room temperature to a constant weight, or to a final percent solids level of at least 99.

Sieving and Grinding. Crush the dry soil using a gloved hand and sieve the material through a No. 10 (2mm) sieve. Discard the sticks, stones, or extraneous matter not passing the sieve. Grind the sieved soil using a glass (or agate) mortar and pestle or similar device, and transfer to a labeled container.

After this sample preparation, the laboratory analyst will mix the sieved sample and take a representative sub-sample of at least 1.0 g, weighted to the nearest 0.01 g, for the digestion procedures.

6.4 Sample Acquisition Methods

6.4.1 Thief Sampler

The "thief" sampler consists of two slotted concentric stainless steel tubes with a pointed tip. The inner tube may be rotated to isolate the sampler interior. It is recommended for use in the sampling of dry granular or powdery soils with a particle diameter less than one third the width of its slots. To take a sample, close the sampler and insert it into the soil to the desired sampling interval. Rotate the inner tube to open t the sampler, withdraw it from the soil, and lay it horizontally, with the slots facing up. Remove the inner tube and transfer the sample to an appropriate sample container or decontaminated compositing bowl.

6.4.2 Sampling Trier

The sampling trier is recommended for use in cohesive soils with a particle size less than half the trier diameter. To acquire a sample, insert the trier into the sampling interval at a 45 degree angle, and rotate the handle 360 degrees to cut soil core. Withdraw the trier with the concave side up, and transfer the sample material to an appropriate sample container or decontaminated compositing bowl.

6.4.3 Slide Hammer Core Sampler

The slide hammer core sampler is recommended for use in rockier soils and soils with a hard, compact surface.

To prepare the sampler for coring, take the following steps:

- Insert a suitable liner into the body (cup);
- Thread the top cap to the upper end of the cup and tighten;
- Attach the extension to the top of the sampler and tighten;
- Attach the slide hammer to the extension and tighten.

To collect a core sample, raise the slide hammer body and allow it to fall to drive the sampler into the soil. Continue until the sampler has been driven to its length. Remove the sampler by tilting and lifting horizontally. Disconnect the sampler from the extension and slide hammer using wrenches if necessary. Keeping the sampler vertical, remove the top cap carefully, using a slip wrench if necessary. Remove the filled liner by first extruding it from the body by pushing up from the sampler lower end. Empty the sample into the appropriate container or compositing bowl. Use a decontaminated liner for each sample.

6.4.4 Portable Auger

Hand- or electric motor-operated portable augers should generally be used in hard-packed soils or sediments. Because of the potential for site contamination, gasoline-powered augers are not permitted unless specifically authorized by approved project-specific plans. To acquire a sample, insert the auger through the catchpan at the desired sampling location and rotate the auger to the required sampling interval. Withdraw the auger and transfer the sample material in the catchpan (or that may have adhered to the auger surface) to an appropriate sample container or decontaminated compositing bowl using a decontaminated stainless steel spoon, trowel, or spatula.

6.4.5 Grab Samples

When permitted by site-specific project plans, grab samples may be taken with a decontaminated shovel or trowel and directly transferred to an appropriate sample container or decontaminated compositing bowl.

6.5 Sample Handling

Sample handling procedures and chain of custody requirements shall be as specified in the governing workplan or SAP. Typical handling procedures for soil samples are as follows:

- If specified in the site workplan or SAP, a photograph should be taken of the soil sample.
- Using a decontaminated stainless steel scoop, empty each soil sample in the mixing bowl to composite.
- Fill the container with a portion of the composited sample. Attempt to maintain the proportion of solids that exist in the mixing bowl while filling containers.
- Store sample containers in coolers for transportation in compliance with the sample handling and chain-of-custody requirements specified in the workplan or SAP.

• Sample documentation and labeling requirements shall be as specified in the governing workplan or SAP.

During soil sampling operations, the proper personal protective equipment will be worn, as described in the applicable workplan or site safety and health plan to minimize cross-contamination.

6.6 Decontamination

Sample acquisition and compositing tools shall be decontaminated as follows:

- 1. Ensure that the cleaning solutions and rinseate containers required by governing sampling plans are available
- 2. Scrub the sample acquisition or compositing tool with a brush and rinse with deionized or distilled water.
- 3. Dispose of the rinseate and wiping rags in the manner specified in governing sampling plans.
- 4. Wrap the decontaminated device securely in clean plastic sheeting or bags pending next use.

7.0 RECORDS MANAGEMENT

The attached Soil Sample Collection Form is to be completely filled out for each corresponding soil sample. This form should be reproduced in a field book along with any notes or unexpected events that may accompany the effort.

8.0 QUALITY ASSURANCE AND QUALITY CONTROL

The approved quality assurance and quality control measures will be applied as described in the applicable workplan or quality assurance plan.

9.0 REFERENCES

ASTM D4700-91 (1998)e1. "Standard Guide for Soil Sampling from the Vadose Zone". ASTM International. Available: www.astm.org

SOIL SAMPLE COLLECTION FORM

Project: P4 Sediment a	and Riparian Soil In	vestigation	Project Numb	er: <u>5020092.11603</u>
Date: / /2010	Time:			
Field Personnel:			Signatures:	
			,	
				·
SITE DESCRIPTION				
Site Location:				
Station Number: M		Photo. No.: _		Roll No.:
GPS Coordinates:	Latitude	• •	Longit	ude
(NAD27)	Elevat	ion		
Comments/Description	ons:			<u> </u>
		···		
				
				<u>. </u>
FIELD DESCRIPTIO	N			
Sample Identification	Number:		_	
Sediment Characteris	stics (color, app	earance, struc	:ture):	
			· · · · · · · · · · · · · · · · · · ·	
Collection Method: :_		·		
Comments/Description	ons:		<u></u>	
			<u> </u>	
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SOP-NW-9.1 COLLECTION OF SURFACE WATER SAMPLES



SOP-NW-9.1

Collection of Surface Water Samples

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1.0 SCOPE

The purpose of this document is to define the standard operating procedures (SOP) for the collection and handling of surface water samples. This SOP applies to any work performed by MWH or subcontractor personnel for any portion of surface water sampling and is intended for use in conjunction with site-specific workplans or sampling and analysis plans (SAPs). Modifications to this SOP may be made with approval of the Project Manager or Task Leader and the Quality Assurance (QA) Manager. Sampling locations shall be as specified in the governing workplan or SAP.

2.0 RESPONSIBILITIES

2.1 Field Sampling Engineer

The Field Sampling Engineer is responsible for sample collection, sample custody in the field, sample preservation, field testing, total and accurate completion of data sheets, sample shipment and delivery of data to the Project Manager, as described in this technical procedure. All staff are responsible for reporting deviations or nonconformance of the procedure to the Field Team Leader, Project Manager, or Quality Assurance (QA) Manager, in compliance with the governing workplan or SAP requirements

2.2 Field Team Leader

The Field Team Leader is responsible for supervising the Field Sampling Engineers. Supervision includes ensuring that samples are collected, documented, preserved, field analyzed, handled and shipped to the appropriate laboratory as specified in project work documents and this technical procedure.

2.3 Project Manager

The Project Manager has overall management responsibilities for the project, is responsible for designing the sampling program, for arranging the logistics of the program, and for providing any required clarifications in the use of this procedure. The Project Manager may assume the responsibilities of the Field Team Leader on smaller projects.

The Project Manager is also responsible for maintaining project files and filing project documents, project correspondence, chain of custody forms, sediment sampling forms, generated data, and other associated and pertinent project information.

2.4 QA Manager

The QA Manager is responsible for developing and managing procedures outlined in the SOPs and in site specific SAPs, QA plans, and/or workplans.

3.0 DISCUSSION

The methods described by this procedure may be used to acquire water samples for chemical or radiological analysis. Methods should be selected at the discretion of the Field Team Leader or Project Manager in accordance with any specific provisions of governing SAPs, QA plans, and/or workplans.

4.0 PROCEDURES

The sampling methods described in this SOP are suitable for collecting water samples that are located at or near active and historic phosphate mines in the southeast Idaho project area. This SOP describes collecting surface water samples at four different types of water bodies. The four types of water bodies are streams, seeps, reservoir or lakes, and standing water locations (ponds). Sample documentation and labeling, as well as, sampling frequency, locations, volumes and analyses shall be as specified in the governing workplan or SAP.

4.1 Decontamination

Before sampling at a new location, all water sample collection equipment will be decontaminated by rinsing the water collection equipment three times with source water, or as specified in the governing workplan or SAP.

4.2 Instrument Calibration

Electronic equipment used during sampling to obtain field parameters will include, but is not limited to, a pH meter with automatic temperature compensation, a specific conductivity meter, a dissolved oxygen meter, a turbidity meter, and an oxidation-reduction potential meter (ORP or eH). Before going into the field, the field team leader will verify that all equipment is operating properly. Calibration, times and appropriate readings will be recorded in the field notebook and as specified in the governing workplan or SAP. Meters will be calibrated according to manufacturer's instructions.

4.3 Filtering

Samples to be analyzed for dissolved state will be filtered during the field sampling event by using a disposable 0.45 micron filter apparatus and peristaltic pump, vacuum pump, syringe, or equivalent equipment. Other samples for a particular analysis may require filtering as specified in the governing workplan or SAP. Filtered samples will be collected according to the following procedure:

- Assemble filter device according to manufacturer's instructions.
- Filter sample either by pouring sample in the top portion of filter unit or pumping it through an in-line filter using the pump or syringe.
- Transfer filtered sample to appropriate sample bottle with required preservative.
- Dispose of the used filter and tubing.
- Decontaminate any reusable filtering equipment. Place decontaminated equipment in a clean

plastic bag or container for transportation between sampling locations.

4.4 Obtaining Water Samples

The following general procedures will be used before collecting surface water samples:

- Describe physical characteristics of the water source to be sampled, including type (seep, pond, stream, reservoir, lake, etc.), any visual discoloration of water, odor, clarity, or any other notable characteristic of the water source.
- Collect field measurements of water quality parameters.
- Assemble all necessary sample collection and filtering equipment.
- Make sure that the sample labels have been correctly filled out for the sampling location. Assemble bottles for filling.
- Decontaminate sample collection equipment by rinsing the equipment three times with source water.
- Collect water sample. Ideally, the sample will be taken from a point away from where the rinsing of collection equipment occurred when sampling standing water or upstream of the rinsing point when collecting flowing water. The water collection container will be lowered into the water, taking care to avoid collecting items floating in the water and disturbing any sediment during sample collection. After the container is filled, carefully lift it out of the water and empty it into a clean sample composite container. Repeat the process at the sampling location until a sufficient amount of sample has been placed into the composite container as described below. The amount of sample to be composited shall be as specified in the governing workplan or SAP.
- Transfer to appropriately labeled containers

4.4.1 Seeps

Water samples will be collected by immersing the sample transfer container as described above, or for a raw sample, the sample container in the water source. This collection method results in a grab sample that characterizes the medium at a point in space and time, and assumes that the water body sampled (seep) is homogeneously mixed and has no stratification. Water sample collection from seeps will be done closest to the point of discharge as possible, to minimize contamination from surficial contact.

4.4.2 Ponds

Water samples will be collected by immersing the sample transfer container as described above, or for a raw sample, the sample container in the water source. This collection method results in a grab sample that characterizes the medium at a point in space and time, and assumes that the water body sampled (pond) is homogeneously mixed and has no stratification due to it's small size. Collecting water

samples from standing water will have the emphasis placed upon the sampler not to disturb the water to be sampled, and the use of a swing sampler to collect as far from the shoreline as possible. This method will be especially important when collecting samples from ponds that have loose material and high gradient slopes that define the pond shoreline, which is typical of mine pit ponds. This will also be important to minimize the immersion risk of sampling personnel. Water samples for ponds may be collected from any point along the shoreline.

4.4.3 Streams and Rivers

Samples will be collected from the same cross section of the stream as that which is used for the discharge (flow) measurement, if discharge is measured. Samples will always be collected prior to making discharge measurements. The sampler will stand downstream of the water to be sampled if safe to do so. If sampling multiple stations on the same stream, downstream samples will always be collected first. Prior to sampling, the stream will be observed for any upstream activities or events that may affect the sample quality. If such events are occurring, the sample will not be collected until the stream clears and the occurrence will be recorded in the field notes.

Selection of sampling methods and equipment based on flow conditions is as follows:

- If the stream is less than 10 ft wide, the sample will be collected from the center of the flow at mid-depth.
- If the stream is greater than 10 ft wide, one composite, consisting of three samples will be collected. The water samples will be taken at 1/4, 1/2, and 3/4 of the distance across the river or stream cross section. These samples should be taken at mid-depth in the water column at each location across the stream channel. All three samples will be composited into one larger container, and apportioned as necessary, into the appropriate sample containers.

Water will be collected from smaller streams and rivers using a standard Kemmerer or Van Dorn horizontal water bottle sampler with the field technician standing downstream and to the side of the bottle. The sampler is a plastic cylinder with rubber stoppers that leave the ends open while being lowered to allow free passage of water through the cylinder. The Kemmerer horizontal water bottle sampler may need to be lowered on a line to reach the desired depth. Once the sampler reaches the desired depth, a 'messenger' is sent down the line, causing the stoppers to close the cylinder, which is then raised. In shallow and faster moving streams and rivers, operation of the Kemmerer horizontal water bottle sampler will be done by hand, and not with a 'messenger'. The water inside the sampler will then be transferred to a clean composite container. The process will be repeated at the sampling location until a sufficient amount of sample has been placed into the composite container. When a sufficient amount has been collected, transfer the water from the composite container into the appropriate sample containers. If unsafe wadding conditions exist (i.e., deep water, fast flowing water, slippery surfaces, etc.) a swing sampler will be utilized instead of the horizontal water bottle sampler to collect sample water for compositing. The method of sample collection shall be recorded in the field notebook.

4.4.4 Reservoirs and Lakes

Each lake and/or reservoir sample consists of collecting and compositing samples at several depths along a vertical profile using a standard Kemmerer or Van Dorn horizontal water bottle sampler. This collection method results in a vertically-composited sample that characterizes the medium at a point in space and time, and takes into account the possibility of the water body sampled (i.e., reservoir or lake) is not homogeneously mixed and may be stratified. The sampler is a plastic cylinder with rubber stoppers that leave the ends open while being lowered to allow free passage of water through the cylinder. Once the sampler reaches the desired depth, a "messenger" is sent down the line to cause the stoppers to close the cylinder, which is then raised. The water inside the sampler will then be transferred to a clean composite container. Repeat the process at the sampling location until a sufficient amount of sample has been placed into the composite container. When a sufficient amount has been collected, transfer the water from the composite container into the appropriate sample containers. A boat shall be utilized to collect samples from reservoirs and lakes.

4.5 Sampling Documentation

A field sampling data sheet will be completed at each sample location. Items not applicable to the sampling will be labeled as not applicable (NA). Sampling information will also be recorded in a bound field notebook. The information recorded on the data sheet and in the field notebook will include the following:

- Sampling location
- Date and time of sampling
- Persons performing the sampling
- Field water quality parameter measurements (specific conductivity, temperature, dissolved oxygen, pH, oxidation-reduction potential, etc.)
- Physical description of the water body to be sampled (color, odor, etc.)
- Sample identification numbers
- Number of samples taken- note containers, analytes, filtering and preservation methods
- Identification numbers of any QC samples from the site
- Any irregularities or problems which may have a bearing on sample quality

4.6 Equipment List

Sample bottles and preservatives (ultra-pure or metal grade nitric acid) will be obtained from the laboratory selected to perform the chemical analyses of the samples. Extra sample bottles with appropriate preservatives will be obtained in case of breakage or other problems.

Equipment used during surface water sample collection includes:

- Camera
- Chain of custody
- Coolers with ice/blue ice
- Copy of this SOP, SOP-NW-9.2 and -9.2a (if applicable) and the governing workplan or SAP

- Dissolved oxygen meter
- Filtering apparatus with disposable 0.45 micron filters
- GPS unit
- Hand pump, peristaltic pump, vacuum pump, or equivalent equipment
- Oxidation-reduction potential meter
- Plastic HDPE sample pitcher
- Plastic squeeze bottle filled with distilled water
- Plastic trash bags
- pH/eH meter (with automatic temperature compensation)
- Rope if obtaining deep samples
- Rite-in-the-RainTM field notebook
- Sample containers that are certified clean
- Sample labels
- Specific conductivity meter
- Strapping and clear tape
- Swing sampler
- Kemmerer or Van Dorn horizontal water bottle sampler
- Suitable HDPE 5 L container
- Turbidity meter
- Silicon tubing
- Wooden stakes
- Writing instruments
- Measuring tape

The governing workplan or SAP may require the use of other equipment based on the scope and objective of an individual project. Project personnel will review the workplan or SAP for any equipment not listed in this SOP.

1.7 Field Quality Assurance/Quality Control Samples

Field QA/QC sample requirements shall be as specified in the governing workplan or SAP.

1.8 Sample Containers

All sample bottles must be properly cleaned and prepared. Coordinate with selected analytical laboratory for appropriate sample bottle types and preparation requirements. Plastic, such as PVC, polyethylene, polypropylene, and Tygon, is an acceptable material for contacting samples when the analyses are for inorganic analytes (metals, radionuclides, anions, and cations). Stainless steel and fluorocarbon resin (Teflon, PTFE, FEP, HDPE, or PFA) are acceptable materials that may contact surface water samples. Glass is an acceptable material for contacting samples except when silica or fluoride analyses are to be performed.

1.9 Sample Handling

Sample handling procedures and chain of custody requirements shall be as specified in the governing workplan or SAP. Typical handling procedures for surface water samples are as follows:

- Store sample containers in coolers for transportation in compliance with the sample handling and chain of custody requirements specified in the workplan or SAP.
- Sample documentation and labeling requirements shall be as specified in the governing workplan or SAP.

All surface water samples shall be labeled and sealed and immediately placed in ice-filled coolers with securely closed lids for storage and transport. The analytical laboratory must receive samples in sufficient time to conduct the requested analyses within the specified holding time.

During surface water sampling operations, the proper personal protective equipment will be worn, as described in the applicable workplan or site safety and health plan, to minimize cross-contamination and ensure to ensure the safety of the field sampling personnel.

SURFACE WATER SAMPLE COLLECTION FORM

Project: Monsanto Interim Surface Water and Sediment In	vestigation Project Number: 5020092.011603
Date: <u>SEP/ /2002</u>	Time:
Field Personnel: Paul Stenhouse, Mark Rettmann	Signatures:
Beth Dolan, Tasha Nava	
SITE DESCRIPTION	
Site Location:	Elevation
Station Number: M Photo No.:	Roll No.:
GPS Coordinates: Latitude°	Longitude°
Comments/Descriptions:	··
FIELD DESCRIPTION	
Sample Identification Number:	<u>M</u>
Surface Water Characteristics (color, odor, appear	rance):
Collection Method: Grab. Kemmerer	<u> </u>

Field Measurements

Parameter	Value				Remarks
	Sample 1	Sample 2	Sample 3		
Air Temperature (°C or F)					
Specific Conductivity (mhos) @ 25° C			!		
Conductivity					
Dissolved Oxygen (mg/L)			!		
pH					
Oxidation-Reduction Potential (ORP)		-	1		
Turbidity (FTU)					
Water Temperature (°C)					

SOP-NW-9.2A SURFACE WATER FLOW MEASUREMENTS USING MAN-PORTABLE DEVICES OR ESTIMATION TECHNIQUES



SOP-NW-9.2a

Surface Water Flow Measurements Using Man-Portable Devices or Estimation Techniques

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1.0 SCOPE

This Standard Operating Procedure (SOP) provides general techniques for obtaining valid, representative flow measurements from natural open-channels using estimation techniques or man-portable devices. Direct methods for flow measurements in open channels using weirs, flumes, or other devices and direct and indirect flow measurements in pipes are provided in SOP-NW-9.2, Surface Water Flow Measurements. This SOP applies to any work performed by MWH or subcontractor personnel for any portion of stream flow measurements and is intended to be used in conjunction with governing work plans or sampling and analysis plans (SAPs). Modifications to this SOP may be made with the approved by the Project Manager or Task Leader and the Quality Assurance (QA) Manager.

Stream flow measurement methods in this SOP assume the following conditions:

- No control structures will be used for flow measurements at surface water stations;
- A current meter will be the preferred method for discharge measurements; and
- A few locations may be appropriate for engineering estimates or volumetric measurement.

2.0 DEFINITIONS

Discharge is defined as the volume rate of flow of water, expressed in cubic feet per second (cfs), including any substances suspended or dissolved in the water. Methods for measuring discharge are based on a variety of flow conditions. Many discharge measurement methods are required because flow conditions differ from site to site.

3.0 RESPONSIBILITIES

3.1 Field Sampling Engineer

The Field Sampling Engineer is responsible for field testing, total and accurate completion of data sheets, and delivery of data to the Project Manager and designated project secretary, all as described in this technical procedure. All staff are responsible for reporting deviations or nonconformance of the procedure to the Field Team Leader, Project Manager, or Quality Assurance (QA) Manager, in compliance with the governing workplan or SAP requirements

3.2 Field Team Leader

The Field Team Leader is responsible for supervising the Field Sampling Engineers. Supervision includes ensuring that stream flows are measured as specified in project work documents and this technical procedure.

3.3 Project Manager

The Project Manager has overall management responsibilities for the project, is responsible for designing the sampling program, for arranging the logistics of the program, and for providing any required clarifications in the use of this procedure. The Project Manager may assume the responsibilities of the Field Team Leader on smaller projects.

The Project Manager is also responsible for maintaining project files and filing project documents, project correspondence, chain of custody forms, surface water flow measurement forms, generated data, and other associated and pertinent project information.

3.4 **QA Manager**

The QA Manager is responsible for developing and managing procedures outlined in the SOPs and in site specific SAPs, QA plans, and/or work plans.

4.0 DISCUSSION

The methods described by this procedure may be used to measure flow in open channels. Methods should be selected at the discretion of the Field Team Leader or Project Manager in accordance with any specific provisions of governing SAPs, QA plans, and/or work plans.

Because of the dynamic nature of surface water behavior, flow measurement by the methods described in this document may, on occasion, be impossible at some sites. It is understood that if unmeasurable flow conditions are encountered at any of the surface water data collection sites which are to be measured in this program, the field team will attempt to measure flow at a point upstream or downstream of the site and will note this point relative to the marked data collection point in the field logbook. Whether or not a measurement is made, the team will note the conditions that inhibited accurate flow measurement. This situation will be brought to the attention of the MWH Project Manager and QA Manager using the field change protocol established in the governing workplan or SAP.

5.0 PROCEDURES

5.1 Velocity-Area Method

Surface flow in stream channels that are greater than one foot wide, or where flow is estimated to exceed 2.0 cfs, will be measured by using the traditional stream gaging technique, the velocity-area method.

When using the velocity-area method to perform discharge measurements of flowing surface water streams, a current meter will be used. The most common current meters are vertical axis meters, such as the Price meter Type AA, and horizontal axis or propeller-type meters. The standard Price meter has a rotor 5 inches in diameter and 2 inches high with six cone-shaped cups mounted on a stainless steel shaft. A pivot bearing supports the rotor shaft. In addition to the type AA meters, a Price pygmy meter is used in shallow depths. The pygmy meter is scaled

two-fifths as large as the standard meter and has no tailpiece. Propeller-type current meters employ a propeller turning about a horizontal axis. Variable flow conditions may require the use of the pygmy meter, the Price AA meter, or a propeller-type meter, depending on the amount of runoff contributing to streamflow.

5.1.1 Theoretical Considerations

The volume rate of flow of water, which is commonly called discharge (Q), is the product of multiplying the average velocity (V) times the total cross-sectional area (A):

$$O = V * A$$

The current meter measures velocity at a point. The velocity-area method of making discharge measurements at a cross-section requires measurement of the mean velocity in multiple portions of the cross-section at each of the selected verticals. These are taken at subsections of the cross-section. A complete discussion of area-velocity methods is found in *Measurement and Computation of Streamflow: Volume 1 - Measurement of Stage and Discharge* (Rantz, 1982)

By dividing the stream width into subsections, total discharge becomes the total of discharges measured in each subsection. Velocity (v) is estimated using the two-point method, or for shallow streams, the six-tenths-depth method, measured at each subsection. The two-point method consists of measuring the velocity at 0.2 and then at 0.8 of the depth from the water surface, and using the average of the two measurements. For streams shallower than 2 feet, the six-tenths-depth method will be used. The six-tenths-method consists of measuring the velocity at 0.6 of the depth from the water surface.

Discharge becomes the sum of the products of each point velocity and cross-sectional area of each subsection:

$$Q = \Sigma (v * a)$$

where:

Q = total discharge (in cubic feet per second),

v = point velocity (feet per second), and,

a = area of the subsection (square feet).

In measuring discharges for developing stream ratings for litigation and flood-plain insurance purposes, federal agencies typically base the number of subsections on the criterion that each subsection contain no more than 5 percent of the total discharge. While this method has reportedly resulted in measurement accuracy as high as 98 percent, factors such as the characteristics of the measurement section reduce this accuracy. Furthermore, measurements limiting flow to 5 percent of the total discharge are time-consuming. Therefore, in the interests of conserving time while maximizing measurement accuracy, current-meter measurements performed in channelized streams will be based on selecting subsections to contain

approximately 10 percent or slightly more of the total discharge. However, the stream should not be partitioned into sections that are significantly greater than 10 percent of the total stream flow because individual measurements that may be in error will then have a significant impact on the overall average velocity determination.

In general, depending on average depth and velocity distribution, a stream less than 2 feet wide will require no more than 8 to 10 subsections. A stream up to 4 feet wide will require about 10 to 12 subsections. Streams wider than 4 feet will require more subsections. Further, subsections need not be of identical width. For example, because velocities near banks are generally lower than velocities near the center of streams, these subsections may be wider than subsections near the center. Subsections will also be more closely spaced if a stream has an unusually deep portion in the cross-section, or if velocities are higher than usual for the cross-section.

Velocity will be observed by current meter at each point for a period that ranges from 40 to 70 seconds. The stage of a stream is the height of the water surface above an established datum plane. The water-surface elevation referred to is some arbitrary gage datum is called the "gage height." Stage or gage height is to be measured and recorded in feet and hundredths of a foot.

5.1.2 Required Measurement Conditions

In order to make a velocity-area discharge measurement using a flowmeter, the following conditions are required:

- The stream must be channelized: that is, observable banks must channel the stream flow;
- Depth must be greater than 0.2 foot across most of the cross-section being measured; and
- The stream must have measurable velocity of at least 0.2 feet per second in most of the cross-section, although the pygmy meter is capable of measuring velocity as low as 0.070 feet per second.

The first two conditions can often be met in streams of very low discharge by conservatively modifying the stream channel to produce a narrower and slightly deeper cross-section in order to meet measurement requirements. These modifications will include removal of aquatic growth or ice, moving large stones which impact velocity upstream or downstream of the cross-section, and narrowing or deepening of the cross-section. By rearranging small amounts of native rock or sand, the technician will produce a measurable cross-section. When such modifications are made, great care will be exercised to avoid unnecessary movement of sediments or the splashing of sediments or water onto field team members. After thus clearing the cross-section, flow will be allowed to stabilize before the current-meter measurement of velocities begins.

If depths of 0.2 feet or greater cannot be found or made, the velocity will be estimated by recording the time required for a floating object to cover a known length of the stream. The object velocity will be calculated by dividing the fixed distance by the recorded time. At a

minimum, five separate trials will be completed and a mean object velocity calculated. For estimation purposes, the mean velocity of the stream will be 65 percent of the average measured stream velocity.

Current meter measurements are best made by wading, if conditions permit. The Price AA, Pygmy, or propeller-type meters are used for wading measurements. Vertical axis current meters do not register velocities accurately when placed close to a vertical wall. A Price meter held close to a right-bank vertical wall will under-register because the slower water velocity near the wall strikes the effective (concave) face of the cups. The converse is true at a left-bank vertical wall. (The terms "left bank" and "right bank" designate direction from the center of a stream for an observer facing downstream). The Price meter also tends to under-register when positioned close to the water surface or close to the streambed.

5.1.3 Equipment

Current meters, timers, depth and width measuring devices, and a means of counting meter revolutions are needed for measurement of discharge. The equipment includes:

- Depth-measuring device
- Current meter
- Width-measuring devices, either engineer's tape or tagline
- Stop watch
- Marker

<u>Depth-Measuring Device</u>. The depth-measuring device may consist of a graduated rod or staff in feet and tenths. If a Price-type meter is used, the depth-measuring device will be the topsetting 2-inch diameter hexagonal wading rod.

<u>Current Meter.</u> A current meter is an instrument used to measure the velocity of flowing water. The principle of operation is based on the proportionality between the velocity of the water and the resulting angular velocity of the meter's rotor. By placing the current meter at a point in a stream and counting the number of revolutions of the rotor during a measured interval of time, the velocity of water at that point is determined.

<u>Engineer's Tape or Tagline</u>. Steel tapes, metallic tapes, or premarked taglines are used for width determinations during discharge measurements made by wading. Direct measurement of width using tapes or taglines can be accurate with proper precautions. Orientation normal to the flow pattern of the river and elimination of most of the sag, through support or tension, are recommended for improved accuracy.

Stop Watch. A stopwatch is used to measure time during which velocity is measured at each point in the cross-section. Velocity at each point is measured for a period greater than or equal to 40 seconds and less than or equal to 70 seconds.

<u>Marker.</u> Each location where the velocity-area method will be consistently applied will be marked with a field stake.

If a Price meter is used, additional equipment includes a headset. A headset attaches to an electronic connection at the upper end of the wading rod.

5.1.4 Maintenance and Calibration Procedures

Prior to use of the current meter and following use of the meter, tests will be conducted to ensure that the unit performs acceptably. For Price-type and propeller-type meters, calibration tests will be conducted prior to and after field work. Calibration tests will be conducted in streams fitted with Parshall flume or equivalent measurement device. Stream velocities derived from flume readings will be compared to the meter readings.

In addition, for Price-type meters, spin tests will be conducted. The spin test will be performed in an enclosed area, such as in the cab of a truck or in the enclosed rear of a truck, to prevent wind interference. The test is to be performed prior to attaching the current meter to the wading rod. While holding the meter steady in an area sheltered from breezes, the technician will spin the rotor and then press the start button on the stop watch. The technician will observe the meter until the rotor ceases to spin. The duration of the spin for the pygmy meter should be more than 40 seconds and for the Price AA meter should be more than 90 seconds. If the meter fails to meet the time-of-spin criteria, the meter will be cleaned and oiled before use. If the meter continues to spin well beyond these time limits, the record will indicate that the meter spun for 40+ seconds, in the case of the pygmy meter, or for 90+ seconds, in the case of the Price AA meter.

To ensure reliable observations of velocity, it is necessary that the selected current meter be kept in good condition. Before and after each discharge measurement, meter cups, vanes, or propellers, pivot and bearing, and shaft should be examined for damage, wear, or faulty alignment. During measurements, the meter will be observed periodically when it is out of the water to be sure that the rotor or propeller spins freely.

Meters will be cleaned and, if applicable, oiled daily when in use. If measurements are made in sediment-laden water, the meter will be cleaned immediately after each measurement. After cleaning and lubrication, the rotor or propeller will be spun to make sure that it operates freely. If the rotor or propeller stops abruptly, the cause of the trouble will be sought and corrected before using the meter.

In addition to meter maintenance, the entire meter unit will be checked before departure to the field each day as follows:

• For Price-type meters, attach the current meter and digital counter/headset to the wading rod. Test the headset by:

- 1. Spinning the current meter to ensure that audible clicks occur.
- 2. If audible clicks do not occur, the following steps should correct the problem:
 - Check that electronic connections are tight;
 - Check that the cat's whisker lightly contacts the upper part of the shaft;
 - Spin again and if audible clicks still do not occur, check that the battery in the headset is properly aligned. Replace the battery, if necessary.
- For propeller-type meters, activate the sensor and test by:
 - 1. Moving the propeller through the air to ensure that electronic readings are displayed.
 - 2. If no display is visible, the following steps should be completed:
 - Check that the batteries have power. Replace if necessary;
 - Check that sensor and display are connected to the shaft wire.

5.1.5 General Considerations

Based on approximate depths, either the Price-type or propeller-type meter will be used to perform a velocity-area measurement. If depths or velocities under natural conditions are too low for a dependable current meter measurement, the cross-section will be modified, if practical, to provide acceptable conditions. A shovel will be used to remove aquatic vegetation, ice, or rocks that may interfere with meter operation or discharge measurement.

At each measurement point (or station) across the stream cross-section, depth is measured prior to measurement of velocity. Therefore, it is recommended that the measuring rod be set with the current meter suspended out of the water and above the tagline, which is used to measure width and to identify stations across the cross-section. Placement of the rod about 0.5 feet downstream from the tagline prevents contact between the tagline and the current meter when the meter is lowered into measuring position. The measuring rod will be placed in the stream so the base rests on the streambed, and the depth of water will then be read from the graduated main rod. The main rod is graduated into 0.l-foot increments.

The meter operator reads water depth directly from the depth-measuring rod. In high velocity areas, it is recommended that depth be read as the value between the depth on the upstream side of the rod and the depth on the downstream side of the rod. Depth is measured to the nearest 0.02 foot. This depth is used to set the vertical location on the current meter.

The meter operator will stand in a position that least affects the velocity of the water passing the current meter. The meter operator will face upstream while holding the depth-measuring rod vertically and close to the tagline or measuring tape. The meter operator stands at about a 45-degree angle downstream from the measuring rod and at least 1.5 feet from the depth-measuring rod. This angle is an imaginary angle between the extended arm holding the depth-measuring rod and the tagline or measuring tape. The meter operator should avoid standing in the water if his or her feet and legs occupy a significantly large percentage of a narrow cross-section. For narrow streams, it is often possible to stand astride the stream.

The depth-measuring rod should be held in a vertical position with the meter parallel to the direction of flow while the velocity is being observed. When measuring streams that have shifting beds, the soundings or velocities can be affected by the scoured depressions left by the hydrographer's feet. For such streams, the meter should be placed ahead of and upstream from the operator's feet.

5.1.6 Discharge Calculations

A stream discharge is the summation of the products of the subsection areas of the stream cross-section and their respective average velocities. The formula $Q = \Sigma$ (v * a) represents the computation, where Q is the total discharge, a is an individual subsection's area, and v is the corresponding mean velocity of flow normal to the subsection. The summation of the discharges for all the subsections is the total discharge of the stream. The order for calculating discharge is:

- Use the distances from initial point to compute width for each section. The first width is computed by subtracting the first distance from the second distance, and dividing this quantity by two. The second width will be the quantity of difference between the third distance and the first distance, divided by two. For each subsequent width, subtract the distance on the line above the line you are calculating from the distance on the line below the line you are calculating, and divide this quantity by two. This procedure is carried out for each line until you reach the final width calculation. This is calculated as the quantity of the difference between the final distance and the second-to-the-last distance, divided by two.
- Subsequent calculations will be performed as follows:
 - Calculate each discharge for each subsection by multiplying the width of the subsection times the depth times the velocity.
 - Sum the discharges for each subsection to arrive at total discharge for the entire cross-section.
- Check your math by summing the subsection widths. Their total should equal the
 value obtained by taking the difference between the left and right bank station
 distances from initial point.

• Initial at the line "Comp. by" to identify yourself as the person responsible for performing the discharge calculation.

5.2 VOLUMETRIC METHOD

The volumetric method is a simple and accurate method for measuring flow from small discharges such as gravity flow discharges from pipe outlets.

5.2.1 Theoretical Considerations

This method involves measuring the time required to fill a container of known capacity, or the time required to partly fill a calibrated container to a known volume. Alternatively, in the case of measuring discharge remotely in a sump or standpipe setting, the volumetric method may be performed by capturing flow in a container for a set period of time, no less than ten seconds. This volume of water is then measured and discharge is determined.

5.2.2 Required Measurement Conditions

Conditions must be such that all discharge from an outlet can be captured in the volumetric container during the period of measurement.

5.2.3 Equipment

The bucket and stop watch technique is particularly useful for the measurement of small flows. Equipment required to make this measurement is a calibrated container and a stopwatch. Calibrated containers of varying sizes will include:

- 5-gallon bucket
- 2-liter graduated cylinder
- 1-liter graduated cylinder
- 1-liter bucket
- 500-milliliter beaker
- 250-milliliter beaker

5.2.4 Maintenance and Calibration Procedures

Graduated cylinders are incremented in terms of milliliters and can be easily converted to gallons. The incremental volume of a 5-gallon bucket can be determined by adding known volumes of water and recording the depth after each addition.

5.2.5 General Considerations

Upon arrival at the site, the sampling personnel will evaluate the flow conditions to select the appropriate method for flow measurement. If flow conditions are appropriate for volumetric measurement, the sampling personnel will observe and use judgment in approximating the flow volume and will select an appropriately sized volumetric container.

Sampling personnel will use a stopwatch to measure the time required to fill a volumetric container. The sampler will time flow into the container for a minimum of 10 seconds. Three consecutive measurements will be made and noted, and the results will be averaged to determine the discharge.

5.2.6 Discharge Calculations

Discharge will be determined initially in gallons per second (gal/s) or in milliliters per second (ml/s). These values will be noted, but the average value will be reported in cubic feet per second. Calculations will be performed as follows:

- Record each of the three measurements in terms of gallons per second or milliliters per second, depending on the volumetric container.
- If one of the three measurements is 50 percent or more different from the other two measurements, then this value will not be used. Instead, three additional measurements will be taken and, provided that none of these three measurements differs by greater than 50 percent from the other two measurements, these values will be used.
- Average the three values.
- Convert the averaged value to cfs as follows:
 - To convert ml/s to cfs, multiply by $3.5. \times 10^{-5}$
 - To convert gal/s to cfs, multiply by 0.134
- Record discharge in cfs.

6.0 REFERENCES

- Linsley R.K, Kohler, M.A., Paulhus, J.L.H. 1982. *Hydrology for Engineers*. McGraw-Hill Book Company. New York, N.Y.
- Rantz, S.E., et al. 1982. Measurement and Computation of Streamflow: Volume 1;

 Measurement of Stage and Discharge. Geological Survey Water-Supply Paper 2175. U.S. Government Printing Office. Washington, D.C.
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- Robertson, J.A., Cassidy, J.J., and Chaudhry, M.H. 1988. *Hydraulic Engineering*. Houghton Mifflin Company. Boston, MA

SURFACE WATER FLOW MEASUREMENT FORM

Project	t: <u>Monsanto</u>	Interim Surf	face Water a	<u>ınd Sedimen</u>	t Investigation	<u>on</u> Project l	Number: <u>5</u>	<u>020092.0°</u>	<u>11603</u>
Date:	SEP/	/2002	Ti	me:					
Field	Personne	l: <u>Paul St</u>	Paul Stenhouse, Mark Rettmann		mann :	Signatures	s:		
		Beth D	olan	Tasha Na	<u>ava</u>				
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Comp. by:	Checked:
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APPENDIX B
HEALTH AND SAFETY PLAN
ACTIVITY HAZARD ANALYSIS

Tasks		Hazards		Controls	PPE Required
Sampling at Operating Mine Sites (including sites undergoing reclamation)	•	Cuts and scrapes	•	Follow procedures of mine operator. Report injuries to buddy or to person designated by mine operator for first aid if necessary. Come to work alert and ready—make sure that general awareness of surroundings is part of job planning and execution. Wear heavy work gloves when handling sharp objects, and point sharp objects toward the ground.	Minimum: hard-hat, safety glasses, boots, long pants, and cotton shirt; heavy work gloves for handling sharp objects. Additional PPE as specified by the mine operator.
	•	Heat or cold stress Slips/trips/falls	•	Monitor for heat and cold stress as outlined in the Health and Safety Plan (see Section 7.0). Maintain general awareness of surroundings.	
	•	Being struck by heavy equipment or caught between equipment and a stationary object	•	Receive site-specific hazard training. Be alert to the direction of traffic flow. Maintain eye contact with heavy equipment operators and give them the right-of-way. Never stand between operating vehicles and nearby stationary objects. Ask the mine operator where the blind spots for each piece of equipment are located—DO NOT STAND IN BLIND SPOTS.	

Tasks		Hazards		Controls	PPE Required
Sampling at Operating Mine Sites (continued)	•	High wall collapse	•	Receive site-specific hazard training. Perform work under escort of mine employee. Do not stand between high wall and heavy equipment—make sure you have an escape route. Know the mine emergency signals and evacuation procedures.	
Sampling at Inactive Mine Sites	•	Cuts and scrapes	•	Report injuries to buddy for first aid if necessary. Come to work alert and ready—make sure that general awareness of site surroundings is part of job planning and execution. Wear heavy work gloves when handling sharp objects, and point sharp objects toward the ground.	Minimum: hard-hat, boots, long pants, and cotton shirt; heavy work gloves for handling sharp objects.
	•	Slips/trips/falls	•	Do not walk at the edge of sharp drop-offs. Maintain special care on scree slopes or while working in other areas with unstable footing. Maintain general awareness of surroundings. Be aware of the possibility of abandoned underground mine portals.	
	•	Dislodged rocks	•	Avoid areas below people who may dislodge rocks while working or walking on slopes. <i>Cry</i> "ROCK" after dislodging a rock when other people are below.	





Tasks	Hazards	Controls	PPE Required
Sampling at Inactive Mine Sites	Deteriorated roads	 Receive site-specific hazard training. Exercise care while traveling by vehicle. 	
(continued)	 High wall collapse or rock-fall 	 Receive site-specific hazard training. Know signs of instability. Carefully examine the surroundings to determine if entry is safe. Be aware of the most efficient evacuation route. Do not walk on top of high walls. Avoid working downslope of rock slides. 	
	• Heat or cold stress	• Monitor for heat and cold stress as outlined in the Health and Safety Plan (see Section 7.0).	
	 Drinking water from streams, mine pits, mine ponds 	 Water in mine pits is of unknown quality, and WILL NOT be used for drinking water. Water purification with iodine, filters, or boiling will not remove potentially toxic metals. 	
	• Drowning	 Personal floatation device (PFD) will be worn during sampling of sediment and surface water from ponds. A throwable flotation device (in the U.S., a Type IV PFD) will also be available during sampling. For stream sampling, conditions should be assess streams with water greater than two feet and moving quickly, sample team could post pone sampling until safer conditions. 	

Tasks		Hazards	Controls	PPE Required
Travel in Remote Areas	•	General	 Always carry ten essentials for wilderness travel (see Table 2-3). 	Heavy work gloves for handling sharp objects.
	•	Slips/trips/falls	 Maintain general awareness of surroundings. 	
	•	Cuts and scrapes	 Report injuries to buddy for first aid. Come to work alert and ready—make sure that general awareness of site surroundings is part of job planning and execution. Wear heavy work gloves when handling sharp objects, and point sharp objects toward the ground. 	
	•	Safe drinking water	 Contact National Forest officials in advance regarding any water quality advisories. Bring sufficient water. Assume that you will need one gallon of drinking water per person per day. 	
	•	Severe weather	 Bring proper rain gear and warm clothes. Listen to weather forecasts before entering remote areas. If severe weather is likely, postpone sampling. In case of lightning, avoid high ground and open areas. In the event of rain, monitor for hypothermia. In the event of snow, monitor for frostbite and hypothermia. In the event of a blizzard that reduces visibility, stay put in an emergency shelter. Do not risk 	

MWH
SUPPLEMENTAL SEDIMENT AND RIPARIAN SOIL HEALTH AND SAFETY PLAN
ACTIVITY HAZARD ANALYSIS

RODUCTION RI/FS

Tasks	Hazards	Controls	PPE Required
Travel in Remote Areas (continued)		disorientation.	
	• Getting lost	 Provide the Program Manager or designee with itineraries, including travel routes and the expected date and time of return. Check in once per day, if possible, when in remote areas. Always check in with the Program Manager or designee before and after sampling. The Program Manager or designee will contact search and rescue if field personnel do not return or call in by the specified time. Bring emergency shelter. If lost, stay put. You are easier to find this way. 	
	• Heat or cold stress	 Monitor for heat or cold stress as outlined in the Health and Safety Plan (see Section 7.0). 	
	Muscle strains	 Know your limits, and do not overextend yourself. 	
	 Poisonous plants and animals 	 Be able to recognize poisonous plants and animals and avoid them. If bitten by a snake or spider, apply cold compresses. Get to a hospital as quickly as possible. 	

5

Tasks Hazards Controls PPE Required

Travel in • Wildlife • Avoid, if possible, and leave the area.

Remote Areas (continued) • Make yourself look large by raising arms and shouting.

• Slowly back away, without turning your back to the animal.

Tasks		Hazards		Controls	PPE Required
General Work Practices	•	First aid injuries	•	Report injuries to buddy for first aid. Seek additional medical attention, if necessary. Notify the PSO.	Minimum: hard-hat, safety glasses, boots, long pants, and cotton shirt.
	•	Slips/trips/falls	•	Practice good housekeeping, and remove or reduce slip/trip/fall hazards. Maintain general awareness of surroundings.	Additional: heavy work gloves and hearing protection, as necessary.
	•	Cuts/scrapes	•	Report injuries to buddy for first aid. Come to work alert and ready—make sure that general awareness of site surroundings is part of job planning and execution. Wear heavy work gloves when handling sharp objects and point sharp objects towards the ground.	
	•	Heat or cold stress	•	Monitor for heat and cold stress as outlined in the Health and Safety Plan (see Section 7.0).	
	•	Muscle strain	•	Alternate activities as needed to give muscles rest.	
	•	Slips/trips/falls	•	Practice good housekeeping to remove or reduce slip/trip/fall hazards.	
	•	Hearing loss.	•	Use hearing protection when operating loud equipment.	

P4 PRODUCTION RI/FS

7

Tasks		Hazards		Controls	PPE Required
General Work Practices (continued)	•	Electrocution. •		Use GFCI on portable power equipment.	
		Power equipment	•	See manufacturers instructions for the use of hand and portable power tools.	

APPENDIX C DOCUMENT COMMENT AND RESPONSES



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY REGION 10 IDAHO OPERATIONS OFFICE

1435 N. Orchard St. Boise, Idaho 83706

August 12, 2010

Barry Koch Special Projects Lead – Mining Monsanto Company P.O. Box 816 Soda Springs, Idaho 83276

Re: Comments on P4 Production, LLC Supplemental Sediment and Riparian Soil Sampling and Analysis Plan Draft Revision θ , prepared for P4 Production by MWH, July 2010.

Dear Mr. Koch,

The Agencies and Tribes (A/T) have reviewed the above referenced deliverable submitted by P4. This work product was developed pursuant to the 2009 RI/FS Settlement Agreement. Our comments are enclosed. If needed, we will be available to discuss these comments during an upcoming conference call, or we can arrange a separate call.

If you have any questions, please contact me. I can be reached at 208-378-5763 or electronically at tomten.dave(a)epa.gov.

Sincerely,

//s//

Dave Tomten Remedial Project Manager

Enclosure

cc: Cary Faulk, MWH (electronic version only)

Vance Drain, MWH (electronic version only)

Mike Rowe, IDEQ

Elton Modroo, IDEO (electronic version only)

Mary Kaufman, FS Jim Alexander, USDA

Forest Service - Enoch Valley Site Record

Jeff Cundick, BLM
Colleen O'Hara, BLM (electronic version only)
Sandi Fisher, US FWS
Kelly Wright, Shoshone Bannock Tribes
Eldine Stevens, BIA (electronic version only)
Susan Hanson (for the tribes)
Nate Walker, Shoshone Bannock Tribes (electronic version only)
Tim Mosko, CH2MHill (electronic version only)
Charles Allbritton, EPA Records Center (electronic version only)

Enclosure

Comments on P4 Production, LLC Supplemental Sediment and Riparian Soil Sampling and Analysis Plan Draft Revision θ , prepared for P4 Production by MWH, July 2010.

General Comments

Please describe the contingencies for future monitoring if more distant stations sampled in 2010 show no contamination (e.g., MST066 at Ballard Mine) while stations closer to the mine sites (e.g. MST069 at Ballard Mine) have show high levels of contamination? Is there a plan to sample an additional station between the "upstream" and "downstream" stations?

Specific Comments

Page 1-3, Section 1.1, paragraph no. 3 and Table 2-2. The proposal to gather data at only two background sampling locations will not provide sufficient information to develop statistically valid site-specific background concentrations of COPCs. A minimum of eight background locations should be sampled, assuming that the variance in the background data set is comparatively small. If the variance in the data set is comparatively large, additional background sampling may be required to develop background concentrations at appropriate confidence levels.

Page 2-1, Section 2.1, 2nd paragraph. It is mentioned that DQOs have been developed for both potential source areas and background areas. Yet, there is no mention in Table 2-1 of background areas. Please revise the Table accordingly.

Page 2-3, Section 2.2.1, 4th bullet. Revise the receptor list to include the possibility that humans may also consume aquatic plants, e.g., water cress.

Page 2-6, Section 2.2.4, last paragraph. Please explain why only Tier 1 ponds warrant sediment sampling. It would seem prudent to include at least Tier 2 as well due to the wallowing nature of grazing animals that could stir up the ponds during use, resuspending the sediments followed by subsequent ingestion.

Page 2-8, Section 2.2.4.1 1st paragraph and Table 2-2. Station MST067 had sediment selenium concentrations of 82 mg/kg in 2004, whereas Station MST066 had sediment selenium concentrations of 3.2 mg/kg in 2004. There are no stations identified between these two stations. Additional stations are needed between these two stations to adequately define the nature and extent of sediment contamination and for estimating costs in the FS for alternatives that address sediment contamination.

Page 2-9, Section 2.2.4.3, 1st paragraph, last sentence. Sediment sampling in Angus Creek needs to be included in the current proposed work. The potential contribution of contaminants from another mine site can be determined after the characterization and risk evaluation.

Page 2-9, Section 2.2.4.2, 2nd paragraph. The background site is identified as MST031. Table 2-2 indicates the background site is MST275. Please reconcile.

Page 2-10, Section 2.2.5, 1st paragraph. Provide a rationale for collecting one sample rather than several samples and compositing them. For example, it may be more representative to collect three borings, along or close to the transect sample point, then to composite into one sample. The reason for the extra borings and the composite would be to reduce the potential uncertainty associated with possible outliers or other anomalies associated with a single soil boring at each sample point.

Page 2-10, Section 2.2.5, 1st paragraph and Appendix A, Section 3.2.2. In the riparian or overbank areas adjacent to stream channels, it is necessary to adequately characterize the nature and extent of any areas potentially contaminated during past high flow events. This information is also needed for cost estimating for addressing potential instream and/or overbank sediment contamination in the FS. Therefore, for the wider stream channels (wider than five feet), riparian/overbank samples should be collected immediately adjacent to the normal stream high water elevation and at the furthest extent of riparian vegetation or at the furthest extent of obvious areas where the stream has experienced overbank flow in the past. Samples should also be collected from both banks of the stream, rather than just one bank of the stream.

Page 3-7, Section 3.2.3. Shouldn't some decontamination occur between samples rather than just sampling locations? For example, a pond will be sampled from 3-5 times. The petite ponar dredge should be decontaminated between samples especially if the first sample is the pond inlet expected to have been most impacted. Please explain how without decontamination between samples, material from previous samples would not contaminate subsequent samples.

Table 1-1. Many of the cells are shaded in different colors. Is there any significance to the shading other than to highlight for what media a parameter was sampled?

Table 2-2. Please identify MST093 as being a background location.

Appendix A, Page 4-4, Section 4.2, 1st full paragraph. State if custody seals be placed on the coolers? If not, why not?

Appendix A, Page 4-7, Section 4.4, 4th paragraph, last sentence. Provide an explanation of what an "RPD of 20.CAS" is.

Editorial Comments on the SAP

Page 2-1, Section 2.0, last sentence. Reword the last sentence as it reads awkwardly.

Page 2-2, Section 2.2, line 3. Change facility to "facilities."

Page 2-9, Section 2.2.4.3, paragraph 1, line 3. Consider replacing monitoring with "monitored."

Page 2-9, Section 2.2.4.3, 1st paragraph, line 11. Change sample to "sampled."

Page 2-11, Section 2.2.5, 3rd paragraph, line 7. Insert "be" between will and representative.

Page 2-12, Section 2.2.6, line 1. Consider changing "... as stand-alone documents ..." to "... as a stand-alone document ..."

Editorial Comments on Appendix A

Page 3-1, Section 3, line 8. Consider changing presented to "present."

Page 3-2, Section 3.1.1, Henry Mine, paragraph 2, line 1. Delete "as having."

Page 3-2, Section 3.1.1, Enoch Valley Mine, paragraph 2, line 1. Change "Enoch Mine" to "Enoch Valley Mine."

Page 4-4, Section 4.3, paragraph 1, line 2. Delete "same that were run during."

Page 4-4, Section 4.3, paragraph 1, line 2. Put a space between "the" and "2009."

Page 4-4, Section 4.3, paragraph 1, line 4. Change "chromium IV" to "chromium VI."

Page 4-6, Section 4.4, paragraph 1, last sentence. Add a period to the end of the sentence.

Page 4-7, Section 4.5, paragraph 2, line 1. Change "3rd-pary" to "3rd-party."

Page 4-7, Section 4.5, paragraph 2, line 10. Change "Min" to "Mine."

Page 5-1, Section 5.3, line 1. Consider changing "... as stand-alone documents..." to "... as a stand-alone document..."

Response to A/T Comments on P4 Production, LLC Supplemental Sediment and Riparian Soil Sampling and Analysis Plan Draft Revision 0 prepared for P4 Production by MWH, July 2010.

General Comments

Please describe the contingencies for future monitoring if more distant stations sampled in 2010 show no contamination (e.g., MST066 at Ballard Mine) while stations closer to the mine sites (e.g. MST069 at Ballard Mine) have show high levels of contamination? Is there a plan to sample an additional station between the "upstream" and "downstream" stations?

Response: At this time, the intent of this sampling effort is to address data gaps associated with COPCs at the existing sampling locations. There exists a great deal of data at the P4 mine sites; however, as discussed in the Supplemental Sediment and Riparian Soil Sampling and Analysis Plan (Sediment SAP), the analyte suite is not consistent with the upland soil analyte suite (i.e., missing some analytes) and therefore additional sampling is necessary to make the data set complete. The objective of this additional work is not to recreate the sediment sampling that has occurred in the past, but just evaluate relevant previous sampling points and to fill in the missing analytes.

Once these new data are collected, sufficient information will be available to conduct a risk assessment for the P4 mine sites. In addition, because these are narrow stream corridors, feasibility studies can use conservative estimations of extent, which may be refined during remedial design or implementation. Therefore, based upon data that we already have for selenium, and the adequacy for risk assessment, we do not anticipate the need for any additional "fill-in" sampling.

Specific Comments

Page 1-3, Section 1.1, paragraph no. 3 and Table 2-2. The proposal to gather data at only two background sampling locations will not provide sufficient information to develop statistically valid site-specific background concentrations of COPCs. A minimum of eight background locations should be sampled, assuming that the variance in the background data set is comparatively small. If the variance in the data set is comparatively large, additional background sampling may be required to develop background concentrations at appropriate confidence levels.

Response: Because of the watershed geomorphology in the area of the mines there are limited opportunities to obtain mine-specific background samples (i.e., the mines are generally in headwater locations, and it is difficult to find upstream locations). However, we agree with the reviewer that two sediment background sampling locations will provide inadequate sample numbers to perform routine statistics or to calculate incremental risk estimates. As a result, we will collect two (2) discrete samples from the locations proposed in the Sediment SAP-Rev 0 plus two additional locations will be added with two (2) samples each for a total of eight (8) background samples. The new locations and rationale for each location will be included in the next revision to the Sediment SAP, including revisions to Table 2-2. The samples collected at the background locations will be obtained from at least 50 feet apart. With this sampling scheme, variability at the station and area level will be included. In addition, it will avoid going outside of the general P4 mine area

to collect background data. Stations MST274 and MST277 will be included in the background assessment.

Page 2-1, Section 2.1, 2nd paragraph. It is mentioned that DQOs have been developed for both potential source areas and background areas. Yet, there is no mention in Table 2-1 of background areas. Please revise the Table accordingly.

Response: Table 2-1 will be revised to include background areas.

Page 2-3, Section 2.2.1, 4th bullet. Revise the receptor list to include the possibility that humans may also consume aquatic plants, e.g., water cress.

Response: Agreed. The Rev 0 text previously stated: "Receptors – aquatic organisms, higher trophic level birds and mammals that consume aquatic organisms, and humans through fish consumption." The final phrase has been modified to read: "and humans through the consumption of fish and culturally significant plants (i.e., water cress)" has been added to the text.

Page 2-6, Section 2.2.4, last paragraph. Please explain why only Tier 1 ponds warrant sediment sampling. It would seem prudent to include at least Tier 2 as well due to the wallowing nature of grazing animals that could stir up the ponds during use, resuspending the sediments followed by subsequent ingestion.

Response: Our ecological CSM does include the incidental ingestion of sediment by livestock. So likely it is appropriate to collect sediment data for ponds that livestock may reasonably be anticipated to use for watering. As a result, select Tier 2 ponds will be included and sampling will be conducted similar to the Tier 1 ponds. The rationale for the individual Tier 2 pond sampling will be included in the next revision of the Sediment SAP. Tier 3 ponds make sense to omit as they are likely only being used occasionally by terrestrial receptors and would probably be characterized as complete, but insignificant for exposure.

Page 2-8, Section 2.2.4.1 1st paragraph and Table 2-2. Station MST067 had sediment selenium concentrations of 82 mg/kg in 2004, whereas Station MST066 had sediment selenium concentrations of 3.2 mg/kg in 2004. There are no stations identified between these two stations. Additional stations are needed between these two stations to adequately define the nature and extent of sediment contamination and for estimating costs in the FS for alternatives that address sediment contamination.

Response: As noted in the first general comment response the intent of the sampling is to address the data gap associated with previously omitted individual COPCs at the existing sediment sampling stations. It is presumed that if the risk assessment indicates that sediment has to be addressed by a remedy, a conservative estimate of the linear feet of channel to be remediated would be utilized during the FS evaluation. In part, this is a reasonable approach because in general the channels are narrow features (few feet in width) with limited sediment volume. The length and width of channel to be remediated would be refined during either remedial design or implementation of the remedy (i.e., during the remedial action) and additional sampling could be conducted at that time to define the limits of e.g., excavation.

Page 2-9, Section 2.2.4.3, 1st paragraph, last sentence. Sediment sampling in Angus Creek needs to be included in the current proposed work. The potential contribution of

contaminants from another mine site can be determined after the characterization and risk evaluation.

Response: Angus Creek originates near the Wooley Valley Mine south of the Enoch Valley Mine. Angus Creek then flows past the Enoch Valley Mine to the south. It receives flow that originates near the Enoch Valley Mine, primarily from Rasmussen Creek. The downstream station on Rasmussen Creek that is immediately above the confluence with Angus Creek (MST-131) had no selenium concentrations in sediment above the detection limit. In addition, for reasons explained in the SAP, sediment transport from the Enoch Valley Mine is not expected. As a result, because there is no indication that contamination from Enoch Valley Mine has extended to Angus Creek, P4 believes sampling is unnecessary in Angus Creek downstream of the Enoch Valley Mine.

Page 2-9, Section 2.2.4.2, 2nd paragraph. The background site is identified as MST031. Table 2-2 indicates the background site is MST275. Please reconcile.

Response: MST275 is correct. The text has been corrected.

Page 2-10, Section 2.2.5, 1st paragraph. Provide a rationale for collecting one sample rather than several samples and compositing them. For example, it may be more representative to collect three borings, along or close to the transect sample point, then to composite into one sample. The reason for the extra borings and the composite would be to reduce the potential uncertainty associated with possible outliers or other anomalies associated with a single soil boring at each sample point.

Response: Agreed. Although the collection of composite samples as described above will require somewhat more field effort (because of multi-point sampling), it will not increase the numbers of samples to be submitted for chemical analysis. In addition the collection of composite samples may have the added benefit of reducing variability in the data. As a result, if the A/Ts want composite samples collected, P4 will collect composite samples at stream and pond locations. The appropriate changes will be made in the document and will be shown in the next version of the Sediment SAP as underlined text to indicate the changes that were made.

Page 2-10, Section 2.2.5, 1st paragraph and Appendix A, Section 3.2.2. In the riparian or overbank areas adjacent to stream channels, it is necessary to adequately characterize the nature and extent of any areas potentially contaminated during past high flow events. This information is also needed for cost estimating for addressing potential instream and/or overbank sediment contamination in the FS. Therefore, for the wider stream channels (wider than five feet), riparian/overbank samples should be collected immediately adjacent to the normal stream high water elevation and at the furthest extent of riparian vegetation or at the furthest extent of obvious areas where the stream has experienced overbank flow in the past. Samples should also be collected from both banks of the stream, rather than just one bank of the stream.

Response: As discussed immediately above, MWH/P4 now has agreed to collect multi-point composite samples at the stream locations. The composite samples will include the locations indicated in the comment. The total number of samples submitted for analysis will not increase but the spatial coverage, including the riparian zones on each side of the channel, will increase (e.g., the riparian soil sample from each location will consist of increments collected on both sides of the stream and near and distal points within the riparian zone).

Page 3-7, Section 3.2.3. Shouldn't some decontamination occur between samples rather than just sampling locations? For example, a pond will be sampled from 3-5 times. The petite ponar dredge should be decontaminated between samples especially if the first sample is the pond inlet expected to have been most impacted. Please explain how without decontamination between samples, material from previous samples would not contaminate subsequent samples.

Response: We agree that some decontamination should occur between samples at an individual sediment sampling location. The sampling equipment will be rinsed or scrubbed to the extent necessary to remove all sediment that may have adhered to the sampling equipment. This may be conducted using potable water or water from the sampling location (e.g., pond water). The text has been revised to include this procedure.

Table 1-1. Many of the cells are shaded in different colors. Is there any significance to the shading other than to highlight for what media a parameter was sampled?

Response: The color was added just for visual effect. However, we understand the A/T confusion and will remove the shading.

Table 2-2. Please identify MST093 as being a background location.

Response: The change has been made to the table.

Appendix A, Page 4-4, Section 4.2, 1st full paragraph. State if custody seals be placed on the coolers? If not, why not?

Response: Custody seals will be used. The text has been revised to clarify this.

Appendix A, Page 4-7, Section 4.4, 4th paragraph, last sentence. Provide an explanation of what an "RPD of 20.CAS" is.

Response: "RPD of 20" the letters "CAS" will be removed. RPD is relative percent difference as defined earlier in the document.

Editorial Comments on the SAP

Response: Agree with your proposed editorial changes. The comments suggested by the A/Ts on the SAP and Appendix A below have been implemented in the revised document.

Page 2-1, Section 2.0, last sentence. Reword the last sentence as it reads awkwardly.

Page 2-2, Section 2.2, line 3. Change facility to "facilities."

Page 2-9, Section 2.2.4.3, paragraph 1, line 3. Consider replacing monitoring with "monitored."

Page 2-9, Section 2.2.4.3, 1st paragraph, line 11. Change sample to "sampled."

Page 2-11, Section 2.2.5, 3rd paragraph, line 7. Insert "be" between will and representative.

Page 2-12, Section 2.2.6, line 1. Consider changing "... as stand-alone documents ..." to "... as a stand-alone document ..."

Editorial Comments on Appendix A

Page 3-1, Section 3, line 8. Consider changing presented to "present."

Page 3-2, Section 3.1.1, Henry Mine, paragraph 2, line 1. Delete "as having."

Page 3-2, Section 3.1.1, Enoch Valley Mine, paragraph 2, line 1. Change "Enoch Mine" to "Enoch Valley Mine."

Page 4-4, Section 4.3, paragraph 1, line 2. Delete "same that were run during."

Page 4-4, Section 4.3, paragraph 1, line 2. Put a space between "the" and "2009."

Page 4-4, Section 4.3, paragraph 1, line 4. Change "chromium IV" to "chromium VI."

Page 4-6, Section 4.4, paragraph 1, last sentence. Add a period to the end of the sentence.

Page 4-7, Section 4.5, paragraph 2, line 1. Change "3rd-pary" to "3rd-party."

Page 4-7, Section 4.5, paragraph 2, line 10. Change "Min" to "Mine."

Page 5-1, Section 5.3, line 1. Consider changing "... as stand-alone documents..." to ". .. as a stand-alone document..."



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY REGION 10

IDAHO OPERATIONS OFFICE

1435 N. Orchard St. Boise, Idaho 83706

September 2, 2010

Barry Koch Special Projects Lead – Mining Monsanto Company P.O. Box 816 Soda Springs, Idaho 83276

Re: Comments on P4's Response to A/T Comments on P4 Production, LLC Supplemental Sediment and Riparian Soil Sampling and Analysis Plan Draft Revision 0, dated August 19, 2010.

Dear Mr. Koch,

The Agencies and Tribes (A/T) have reviewed the above referenced deliverable submitted by P4. This work product was developed pursuant to the 2009 RI/FS Settlement Agreement. Our comments on the response to comments document are enclosed. If needed, we will be available to discuss these comments during an upcoming conference call, or we can arrange a separate call.

If you have any questions about this matter, please contact me. I can be reached at 208-378-5763 or electronically at tomten.dave@epa.gov.

Sincerely,

//s//

Dave Tomten Remedial Project Manager

Enclosure

cc: Cary Faulk, MWH (electronic version only)

Vance Drain, MWH (electronic version only)

Mike Rowe, IDEQ

Elton Modroo, IDEQ (electronic version only)

Mary Kaufman, FS Jim Alexander, USDA Forest Service - Enoch Valley Site Record
Jeff Cundick, BLM
Sandi Fisher, US FWS
Kelly Wright, Shoshone Bannock Tribes
Susan Hanson (for the tribes)
Nate Walker (electronic version)
Colleen O'Hara, BLM (electronic version only)
Eldine Stevens, BIA (electronic version only)
Tim Mosko, CH2MHill (electronic version only)
Charles Allbritton, EPA Records Center (electronic version only)

Enclosure

Comments on P4's Response to A/T Comments on P4 Production, LLC Supplemental Sediment and Riparian Soil Sampling and Analysis Plan Draft Revision 0, dated August 19, 2010.

General Comment

During our biweekly conference call held on August 30, 2010, a question arose regarding which fraction of sediment will be sampled. The resolution was that the 2010 sampling procedures will be the same as the 2004 sediment sampling procedures to promote comparability between data sets. This should be clearly stated in the referenced work plan documents along with clarification on specific procedures and target size fraction for analysis.

Specific Comments

Page 2-8, Section 2.2.4.1 1st paragraph and Table 2-2. Station MST067 had sediment selenium concentrations of 82 mg/kg in 2004, whereas Station MST066 had sediment selenium concentrations of 3.2 mg/kg in 2004. There are no stations identified between these two stations. Additional stations are needed between these two stations to adequately define the nature and extent of sediment contamination and for estimating costs in the FS for alternatives that address sediment contamination.

P4 August 19, 2010 Response: As noted in the first general comment response the intent of the sampling is to address the data gap associated with previously omitted individual COPCs at the existing sediment sampling stations. It is presumed that if the risk assessment indicates that sediment has to be addressed by a remedy, a conservative estimate of the linear feet of channel to be remediated would be utilized during the FS evaluation. In part, this is a reasonable approach because in general the channels are narrow features (few feet in width) with limited sediment volume. The length and width of channel to be remediated would be refined during either remedial design or implementation of the remedy (i.e., during the remedial action) and additional sampling could be conducted at that time to define the limits of e.g., excavation.

A/T Response: During the A/T/P4 conference call on August 30, 2010, we discussed an apparent misunderstanding regarding the proposed sediment sampling stations southwest of Ballard. During that call, we agreed that intermediate sediment sampling locations between MST067 and MST066 would not be necessary. We agree that an estimate of the metal concentrations in sediment based on a lineal extrapolation between MST067 and MST066 is a conservative approach, thus is acceptable to the A/T. However, as previously noted, one or more intermediate locations may be advisable for estimating costs in the FS for alternatives that address sediment contamination.

There also appeared to be agreement that an additional sediment sample will be collected near the toe of MWD081 at MST067. However, the A/T would like P4

to consider substituting the MST067 sediment sample with a sample at MST069 if MST069 is representative of site conditions. A sediment sample from MST069 appears justified because the selenium concentration in its 2004 sample (420 mg/kg) was substantially higher than other comparable locations and was substantially higher than the maximum soil selenium concentration reported for the MWD081 waste dump (141 mg/kg).

Page 2-9, Section 2.2.4.3, 1st paragraph, last sentence. Sediment sampling in Angus Creek needs to be included in the current proposed work. The potential contribution of contaminants from another mine site can be determined after the characterization and risk evaluation.

P4 August 19, 2010 Response: Angus Creek originates near the Wooley Valley Mine south of the Enoch Valley Mine. Angus Creek then flows past the Enoch Valley Mine to the south. It receives flow that originates near the Enoch Valley Mine, primarily from Rasmussen Creek. The downstream station on Rasmussen Creek that is immediately above the confluence with Angus Creek (MST-131) had no selenium concentrations in sediment above the detection limit. In addition, for reasons explained in the SAP, sediment transport from the Enoch Valley Mine is not expected. As a result, because there is no indication that contamination from Enoch Valley Mine has extended to Angus Creek, P4 believes sampling is unnecessary in Angus Creek downstream of the Enoch Valley Mine.

A/T Response: The sentence "Angus Creek will not be sampled because of the presence of other potential sources in the Angus Creek watershed" should be removed from the SAP because potential contributions from other mines is not a valid rationale for not sampling at Angus Creek. However, P4's rationale provided above is sufficient and should replace the stricken sentence, even if it is repetitive of similar statements made elsewhere in the referenced document.

Page 2-10, Section 2.2.5, 1st paragraph and Appendix A, Section 3.2.2. In the riparian or overbank areas adjacent to stream channels, it is necessary to adequately characterize the nature and extent of any areas potentially contaminated during past high flow events. This information is also needed for cost estimating for addressing potential instream and/or overbank sediment contamination in the FS. Therefore, for the wider stream channels (wider than five feet), riparian/overbank samples should be collected immediately adjacent to the normal stream high water elevation and at the furthest extent of riparian vegetation or at the furthest extent of obvious areas where the stream has experienced overbank flow in the past. Samples should also be collected from both banks of the stream, rather than just one bank of the stream.

P4 August 19, 2010 Response: As discussed immediately above, MWH/P4 now has agreed to collect multi-point composite samples at the stream locations. The composite samples will include the locations indicated in the comment. The total number of samples submitted for analysis will not increase but the spatial coverage, including the riparian zones on each side of the channel, will increase (e.g., the riparian soil sample

from each location will consist of increments collected on both sides of the stream and near and distal points within the riparian zone).

A/T Response: For the purpose of clarification, please specify that the intent of P4's response statement "The composite samples will include the locations indicated in the comment" is meant to comply with the A/T request that P4's sampling plan be revised to address the following:

- Potential in-stream and/or overbank sediment contamination
- At wider stream channels (wider than five feet), riparian/overbank samples
 will be collected immediately adjacent to the normal stream high water
 elevation and at the furthest extent of riparian vegetation or at the furthest
 extent of obvious areas where the stream has experienced overbank flow in
 the past.
- Sample collection from both banks of the stream, rather than just one bank of the stream.

Furthermore, P4 states that the total number of samples for analysis will not increase. Please clarify if P4 intends to collect and submit separate samples from each bank if both banks require sampling or if P4 intends to composite samples from both banks. This may be appropriate for screening purposes and risk assessment, but separate bank samples may prove necessary for defining the extent of contamination and for estimating costs in the FS for alternatives that address sediment contamination.



September 9, 2010

Mr. Dave Tomten **USEPA** 1435 N. Orchard Street Boise, ID 83706

RE: P4's September 9, 2010 Response to additional A/T Comments on P4's initial Response to A/T Comments on the Supplemental Sediment and Riparian Soil Sampling and Analysis Plan Draft Revision 0

Dear Dave:

Please find P4 Production's attached responses to the additional Agencies' and Tribes' (A/T's) comments. The Supplemental Sediment and Riparian Soil Sampling and Analysis Plan - Draft Revision 0 (Supplemental Sediment SAP) was originally submitted to the A/Ts on July 21, 2010. The initial A/T comments on the Supplemental Sediment SAP were received on August 12, 2010. P4 prepared response to these comments (RTCs) that were submitted electronically to the A/Ts on August 19, 2010. Additional A/T comments were received on September 2, 2010 in response to P4's initial RTC document. The attached P4 RTC document then is in response to these additional A/T comments.

At this time, we are providing this information only electronically so that the A/Ts can review these RTCs before we revise the Supplemental Sediment SAP. MWH/P4 would like to discuss these RTCs on the next bi-weekly call on September 13, 2010 so that we can receive tentative approval of the Supplemental Sediment SAP and get into the field this fall.

Once the RTCs are formally approved by the A/Ts, we will revise and submit all the required electronic and hardcopy versions of the RTCs and the Supplemental Sediment SAP as specified by the AOC. In this case, the Supplemental Sediment SAP will in inserted into Appendix D1 of the RI/FS Work Plan for P4's Ballard, Henry and Enoch Valley Mines. We look forward to your approval of the attached RTCs and tentative approval of the field effort associated with the Supplemental Sediment SAP as soon as possible.

Should you have any questions on this information prior to that conference call, please contact Barry Koch at (208) 547-1439.

Best Regards,

Vance Drain, P.G. (PM for P4)

Mr. Dave Tomten USEPA September 9, 2010 Page 2 of 2

MWH Project File

Distribution List

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P4's September 9, 2010 Response to Additional A/T Comments on P4's Initial Response to A/T Comments on the Supplemental Sediment and Riparian Soil Sampling and Analysis Plan Draft Revision 0

General Comment

During our biweekly conference call held on August 30, 2010, a question arose regarding which fraction of sediment will be sampled. The resolution was that the 2010 sampling procedures will be the same as the 2004 sediment sampling procedures to promote comparability between data sets. This should be clearly stated in the referenced work plan documents along with clarification on specific procedures and target size fraction for analysis.

P4 September 9, 2010 Response: As agreed during the call, 2010 sediment and soil procedures will be consistent with historic sampling procedures to support consistency amongst the sampling programs. Throughout the history of sediment and soil sample collection and analysis at the P4 Sites, the sample preparation has been conducted in the laboratory. This conclusion was reached following review of the the Standard Operating Procedures (SOPs) for the sediment sampling that occurred in 2002 and 2004, as well as the SOP and Quality Assurance Program Plan (QAPP) for the 2009 soil and vegetation sampling. This laboratory work has included air-drying, sieving, and grinding prior to digesting the sample aliquot. The revised Field Sampling Plan (FSP) for the sediment and riparian soil sampling effort will reference updated SOPs. The updated SOPs will include specific details and procedures (e.g., sieve the material through a No. 10 [2mm] sieve) that the laboratory will utilize for the 2010 sediment and riparian soil sampling program.

Specific Comments

Page 2-8, Section 2.2.4.1 1st paragraph and Table 2-2. Station MST067 had sediment selenium concentrations of 82 mg/kg in 2004, whereas Station MST066 had sediment selenium concentrations of 3.2 mg/kg in 2004. There are no stations identified between these two stations. Additional stations are needed between these two stations to adequately define the nature and extent of sediment contamination and for estimating costs in the FS for alternatives that address sediment contamination.

P4 August 19, 2010 Response: As noted in our first general comment response, the intent of this sampling effort is to address the data gap associated with previously omitted individual COPCs at the existing sediment sampling stations. It is presumed that if the risk assessment indicates that sediment has to be addressed by a remedy, a conservative estimate of the linear feet of channel to be remediated will be utilized during the FS evaluation. In part, this is a reasonable approach because in general the channels are narrow features (few feet in width) with limited sediment volume. The length and width of channel to be remediated would be refined during either remedial design or implementation of the remedy (i.e., during the remedial action) and additional sampling could be conducted at that time to define the limits of e.g., excavation.

A/T Response: During the A/T/P4 conference call on August 30, 2010, we discussed an apparent misunderstanding regarding the proposed sediment sampling stations southwest of Ballard. During that call, we agreed that intermediate sediment sampling locations between MST067 and MST066 would not be necessary. We agree that an estimate of the metal concentrations in sediment based on a lineal extrapolation between MST067 and MST066 is a conservative approach, thus is acceptable to the A/T. However, as previously noted, one or more intermediate locations may be advisable for estimating costs in the FS for alternatives that address sediment contamination.

There also appeared to be agreement that an additional sediment sample will be collected near the toe of MWD081 at MST067. However, the A/T would like P4 to consider substituting the MST067 sediment sample with a sample at MST069 if MST069 is representative of site conditions. A sediment sample from MST069 appears justified because the selenium concentration in its 2004 sample (420 mg/kg) was substantially higher than other comparable locations and was substantially higher than the maximum soil selenium concentration reported for the MWD081 waste dump (141 mg/kg).

P4 September 9, 2010 Response: As discussed during the call, we agree that a sample should be collected near MWD081 upgradient of MST066 and that MST067 was inadvertently left off the list of sampling locations. While, we don't disagree that based on historic concentration data, MST069, appears to be a worst-case location, we need to point out that there is not a hydraulic connection between MST069 and MST066 (i.e., located within different drainage channels). In order to assess sediment transport on the west side of Ballard Mine, we propose that samples be collected at MST066 and MST067 as these two stations are located within the same drainage feature and are hydraulically connected.

Page 2-9, Section 2.2.4.3, 1st paragraph, last sentence. Sediment sampling in Angus Creek needs to be included in the current proposed work. The potential contribution of contaminants from another mine site can be determined after the characterization and risk evaluation.

P4 August 19, 2010 Response: Angus Creek originates near the Wooley Valley Mine south of the Enoch Valley Mine. Angus Creek then flows past the Enoch Valley Mine to the south. It receives flow that originates near the Enoch Valley Mine, primarily from Rasmussen Creek. The downstream station on Rasmussen Creek, immediately above the confluence with Angus Creek (MST-131), had no selenium concentrations in sediment above the detection limit. In addition, for reasons explained in the SAP, sediment transport from the Enoch Valley Mine is not expected. As a result, because there is no indication that contamination from Enoch Valley Mine has extended to Angus Creek, P4 believes sampling is unnecessary in Angus Creek downstream of the Enoch Valley Mine.

A/T Response: The sentence "Angus Creek will not be sampled because of the presence of other potential sources in the Angus Creek watershed" should be removed from the SAP because potential contributions from other mines is not a valid rationale for not sampling at Angus Creek. However, P4's rationale provided above is sufficient and should replace the stricken sentence, even if it is repetitive of similar statements made elsewhere in the referenced document.

P4 September 9, 2010 Response: P4 has removed the sentence (Section 2.2.4.3, 1st paragraph, last sentence) as requested by the A/T and will replace the sentence with P4's rationale from the August 19th response presented above.

Page 2-10, Section 2.2.5, 1st paragraph and Appendix A, Section 3.2.2. In the riparian or overbank areas adjacent to stream channels, it is necessary to adequately characterize the nature and extent of any areas potentially contaminated during past high flow events. This information is also needed for cost estimating for addressing potential instream and/or overbank sediment contamination in the FS. Therefore, for the wider stream channels (wider than five feet), riparian/overbank samples should be collected immediately adjacent to the normal stream high water elevation and at the furthest extent of riparian vegetation or at the furthest extent of obvious areas where the stream has experienced overbank flow in the past. Samples should also be collected from both banks of the stream, rather than just one bank of the stream.

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P4 September 9, 2010 Response: P4's August 19th response proposed to collect one composite sample across a transect of the riparian zone on both sides of the channel (e.g., the riparian soil sample from station MST092 would have consisted of increments collected on both sides of the stream at near and distal points within the riparian zone and composited into one sample). Upon review of photographs taken of the proposed stream locations, P4 observed that a majority of the streams stations do not exhibit well defined channels and are often less than five feet wide. At most of the locations, there is no obvious geomorphic "high water mark" or riparian vegetation to demark the extent of the channel. Based on this review, P4 is proposing to collect one composite sample from each bank that will be submitted for analysis. The composite sample from each bank would be collected perpendicular to the channel along a minimum 2-foot span beginning at the bank and continuing at 1 foot intervals until 3 sample increments were collected for compositing as illustrated at MST092 location below. Should there be an obvious bench at a stream sample location; the 3 individual samples for compositing would be spaced evenly across the bench. The composite sediment sample in the center of the channel also would be comprised of three sample increments.

